
Cost-Effectiveness of Lumbar Spondylolisthesis Surgery at 2-Year Follow-up
Fischer, C R; Cassilly, R; Dyrszka, M; Trimba, Y; Peters, A; Goldstein, J A; Spivak, J; Bendo, J A
Objectives The purpose of this study was to determine the cost/quality-adjusted life-year (QALY) of the operative treatment of lumbar spondylolisthesis and identify factors associated with cost-effectiveness at 2 years. Methods We evaluated patients who underwent surgery for spondylolisthesis. The QALY was determined from the EQ5D. Outcomes were also assessed using the Oswestry Disability Index (ODI). Surgical, neuromonitoring, and anesthesia Current Procedural Terminology (CPT) codes as well as hospital Diagnosis-Related Group codes were used to determine the Medicare direct care costs of surgery. Indirect costs were modeled based on existing literature. A discounting rate of 3% was applied. Analysis was performed to determine which factors were associated with a cost/QALY less than $100,000. Results There were 44 patients who underwent surgery for either degenerative (30) or isthmic spondylolisthesis (14). There were 27 women and 17 men, with an average age at surgery of 59.7 years (standard deviation [SD] = 14.69) and an average follow-up of 2 years (SD = 0.82). The average postoperative improvement in ODI was 24.77 (SD = 23.9), and change in QALY was 0.43 (SD = 0.30). The average cost/QALY at 2 years for direct care costs was $89,065. The average cost/QALY at 2 years for direct plus indirect costs was $112,588. Higher preoperative leg pain and greater leg pain change was associated with a cost/QALY <$100,000 (p <.005, p <.028). The cost-effective group had a higher proportion of patients with disease extent of two or more levels (p =.021). When comparing surgical techniques of anterior-posterior and posterior only, there was no difference in cost-effectiveness. Conclusions Spondylolisthesis surgery is cost-effective at 2 years, with a QALY change of 0.43 and a direct cost/QALY of $89,065. Higher preoperative leg pain and larger extent of disease was associated with cost-effectiveness. Level of Evidence IV
EMBASE:20151060887
ISSN: 2212-134x


Erratum to: Advancing drug delivery systems for the treatment of multiple sclerosis
Tabansky, Inna; Messina, Mark D; Bangeranye, Catherine; Goldstein, Jeffrey; Blitz-Shabbir, Karen M; Machado, Suly; Jeganathan, Venkatesh; Wright, Paul; Najjar, Souhel; Cao, Yonghao; Sands, Warren; Keskin, Derin B; Stern, Joel N H

PMID: 26895430
ISSN: 1559-0755


Ninety-day readmissions after degenerative cervical spine surgery: A single-center administrative database study
Akamnonu, Chibuikem; Cheriyan, Thomas; Goldstein, Jeffrey A; Errico, Thomas J; Bendo, John A
BACKGROUND: Unplanned hospital readmissions result in significant clinical and financial burdens to patients and the healthcare system. Readmission rates and causes have been investigated using large administrative databases which have certain limitations in data reporting and coding. The objective of this study was to provide a description of 90 day post-discharge readmissions following surgery for common degenerative cervical spine pathologies at a large-volume tertiary hospital. The study also compared the re-admission rates of patients who underwent anterior- and posterior-approach procedures. METHODS: The administrative records from a single-center, high-volume tertiary institution
were queried using ICD-9 codes for common cervical pathology over a three year period to determine the rate and causes of readmissions within the 90 days following the index surgery. RESULTS: A total of 768 patients underwent degenerative cervical spine surgery during the three year study period. Within 90 days of discharge, 24 (3.13%) patients were readmitted; 16 (2.06%) readmissions were planned for lumbar surgery; 8 (1.04%) readmissions were unplanned. 640 patients underwent procedures involving an anterior approach and 128 patients underwent procedures involving a posterior approach. There were 14 (2.17%) planned readmissions in the anterior group and 2 (1.5%) in the posterior group. The unplanned readmission rate was 0.63% (4 patients) and 3.13% (4 patients) in the anterior and posterior groups, respectively. (p=0.0343). CONCLUSION: The 90 day post-discharge unplanned readmission rate that followed elective degenerative cervical spine surgery was 1.04%. The unplanned readmission rate associated with posterior-approach procedures (3.13%) was significantly higher than that of anterior-approach procedures (0.63%). LEVEL OF EVIDENCE: IV.

Unplanned hospital readmission after surgical treatment of common lumbar pathologies: rates and causes
Akamnonu, Chibuikem; Cheriyan, Thomas; Goldstein, Jeffrey A; Lafage, Virginie; Errico, Thomas J; Bendo, John A
STUDY DESIGN: Retrospective cohort study. OBJECTIVE: To assess the rate and causes of unplanned readmissions after surgical treatment of common degenerative lumbar pathologies within 90 days.
SUMMARY OF BACKGROUND DATA: With pay-for performance and bundled payment compensation models being implemented; there is a growing emphasis to decrease the number of unplanned readmissions after surgery. Reports on degenerative lumbar spine pathology readmission rates are often obtained from national databases that lack clinical detail. Less published are the results from single-center institutions. METHODS: Hospital administrative database from a single-tertiary institution was queried to identify patients who underwent surgery for 6 common lumbar pathologies during a period from 2011 to 2013. All readmissions within 90 days of discharge were reviewed for cause and rate of unplanned readmissions was calculated. RESULTS: A total of 1306 patients were identified who underwent surgery for various lumbar pathologies during a 2-year time period. There were a total of 70 readmissions captured in the database that included 14 planned, 43 unplanned readmissions, and 13 coding errors. The unplanned readmission rate varied between 2.1% and 7.1% depending on pathology, with an overall rate of 3.3% within 90 days of discharge. Index length of stay, discharge disposition, severity of illness scores, and surgical approach were associated with readmission. The addition of fusion to decompression procedures did not seem to increase readmission rates. Surgical site infections and wound complications were the 2 most common reasons for readmissions accounting for 72% of all readmissions during the 90-day postdischarge period. CONCLUSION: The rate of readmission after surgery for common lumbar degenerative pathologies is relatively low. Surgical site infections and wound complications were the most common cause of readmission in this patient cohort. LEVEL OF EVIDENCE: 4.
PMCID: 4480048
PMID: 26114088
ISSN: 2211-4599

Spine journal. 2015;15(10):S169-S170. DOI:
Association between compensation and outcomes in spine surgery: A meta-analysis of 31 studies
[Meeting Abstract]
BACKGROUND CONTEXT: Numerous studies have demonstrated poorer outcomes in patients receiving Workers' Compensation following treatment of various health conditions including spine disorders. It is thus important to consider compensation status when assessing treatment outcomes in spine surgery. However, reported strengths of association have varied significantly (1.31-7.22). PURPOSE: The objective of this study was to evaluate the association of unsatisfactory outcomes on compensation status in spine surgery patients.

STUDY DESIGN/SETTING: Meta-analysis. PATIENT SAMPLE: 3567 patients undergoing spine surgery. OUTCOME MEASURES: Demographics, type of surgery, country, follow-up time, patient satisfaction, return to work and non-union events. METHODS: Both prospective and retrospective studies that compared outcomes between compensated and non-compensated patients in spine surgery were included. Outcome data extracted by two independent investigators. The meta-analysis was performed using Revman software. Depending on heterogeneity, a fixed or random effects model was used to calculate risk ratio (RR, 95% confidence interval [CI]) for dichotomous variables.

RESULTS: 31 studies (13 prospective; 18 retrospective) with a total of 3,567 patients were included in the analysis. Follow-up time varied from 4 months to 10 years. Twelve studies involved only decompression; the rest were fusion. Overall RR of an unsatisfactory outcome was 2.12 [1.74, 2.58; p<0.001] in compensated patients when compared to noncompensated patients after surgery. RR of an unsatisfactory outcome in compensated patients compared to noncompensated was 2.09 [1.38, 3.17; p< 0.01 among studies from Europe and Australia and 2.14 [1.48, 2.60]; p< 0.01 among US studies. RR of decompression-only procedures was 2.53 [1.85, 3.47] and 1.79 [1.45, 2.21] for fusion. 52% (182/491) of compensated patients returned to work versus 82% (1034/1250) of non-compensated (RR 0.73 [0.59, 0.90]; p<0.001). 25% (74/292) and 13.5% (39/287) of patients had nonunion in the compensated and noncompensated groups, respectively. This was not statistically significant (RR 1.33 [0.92, 1.91]; p=0.07).

CONCLUSIONS: Workers' Compensation patients have a two-fold increased risk of an unsatisfactory outcome compared to noncompensated patients after surgery. This association was consistent when studies were grouped by country or procedure. Compensation status must be considered in all surgical intervention studies.
independent reviewers. Meta-analysis was performed using RevMan 5. Weighted standardized mean difference (SMD) and odds ratio (OR) 95% confidence intervals (CI) were calculated. Jadad scoring was used to assess bias of included studies. RESULTS: Eight RCTs were included, having a total of 549 patients (267 unilateral/282 bilateral). Minimum follow-up ranged from 3 to 24 months. Bias-assessment scores varied between 0 and 3 indicating high-moderate bias-risk. Six involved open TLIF procedures and two involved minimally invasive TLIF. There was no difference between postoperative Health Related Quality of Life scores in the unilateral and bilateral instrumented groups (SMD = 0.29; [-0.77, 0.18]; p=0.69). There was no statistical difference in fusion rates (OR = 0.47; 95% CI [0.21, 1.04], p=0.68), with 88.9% and 95.0% achieving fusion in the unilateral and bilateral groups, respectively. The unilateral cohort had a higher incidence of cage migration (5.6%) when compared to the bilateral cohort (2.5%), approaching statically significant (p=0.07). Other complications which included dural tears, deep vein thrombosis, surgical site infections and screw failures were comparable between the groups. CONCLUSIONS: Fusion rates and complications appear comparable in unilateral and bilateral instrumentation in TLIF. Though not statistically significant, there was higher incidence of cage migration in the unilateral cohort.

EMBASE:72100398
ISSN: 1529-9430


Association between compensation status and outcomes in spine surgery: a meta-analysis of 31 studies
Cheriyan, Thomas; Harris, Bradley; Cheriyan, Jerry; Lafage, Virginie; Spivak, Jeffrey M; Bendo, John A; Errico, Thomas J; Goldstein, Jeffrey A

BACKGROUND CONTEXT: Numerous studies have demonstrated poorer outcomes in patients with Workers’ Compensation (WC) when compared to those without WC following treatment of various health conditions including spine disorders. It is thus important to consider compensation status when assessing treatment outcomes in spine surgery. However, reported strengths of association have varied significantly (1.31-7.22). PURPOSE: The objective of this study was to evaluate the association of unsatisfactory outcomes on compensation status in spine surgery patients. STUDY DESIGN/SETTING: Meta-analysis

PATIENT SAMPLE: Not applicable

OUTCOME MEASURE: Demographics, type of surgery, country, follow-up time, patient satisfaction, return to work and non-union events.

METHODS: Both prospective and retrospective studies that compared outcomes between compensated and non-compensated patients in spine surgery were included. Two independent investigators extracted outcome data. The meta-analysis was performed using Revman software. Random effects model was used to calculate risk ratio (RR, 95% confidence interval (CI) for dichotomous variables). There are no conflicts of interest to report among the authors, and no funding was received for this study. RESULTS: 31 studies (13 prospective; 18 retrospective) with a total of 3567 patients were included in the analysis. Follow-up time varied from 4 months to 10 years. 12 studies involved only decompression; the rest were fusion. Overall RR of an unsatisfactory outcome was 2.12 [1.74, 2.58; p<0.001] in patients with WC when compared to those without WC after surgery. RR of an unsatisfactory outcome in patients with WC, compared to those without, was 2.09 [1.38, 3.17]; p<0.01 among studies from Europe and Australia and 2.14 [1.48, 2.60]; p<0.01 among US studies. RR of decompression-only procedures was 2.53 [1.85, 3.47]; p<0.01 and 1.79 [1.45, 2.21]; p<0.01 for fusion. 43% (209/491) of patients with WC returned to work versus 17% (214/1250) of those without WC (RR 2.07 [1.43, 2.98]; p<0.001). 25% (74/292) and 13.5% (39/287) of patients had non-union in the compensated and non-compensated groups, respectively. This was not statistically significant (RR 1.33 [0.92, 1.91]; p=0.07). CONCLUSIONS: Workers' compensation patients have a two-fold increased risk of an unsatisfactory outcome compared to non-compensated patients after surgery. This association was consistent when studies were grouped by country or
procedure. Compensation status must be considered in all surgical intervention studies.

PMID: 26431997
ISSN: 1878-1632

**Spine. 2015:40(9):629-635. DOI: 10.1097/BRS.0000000000000695**

**Does aspirin administration increase perioperative morbidity in patients with cardiac stents undergoing spinal surgery?**

Cuellar, Jason M; Petrizzo, Anthony; Vaswani, Ravi; Goldstein, Jeffrey A; Bendo, John A

**STUDY DESIGN:** Cohort. **OBJECTIVE:** To compare the perioperative morbidity of patients with cardiac stents after spine surgery who continue to take aspirin before and after the operation with a similar group of patients who preoperatively discontinued aspirin. **SUMMARY OF BACKGROUND DATA:** The preoperative discontinuation of anticoagulant therapy has been the standard of care for orthopedic surgical procedures. However, recent literature has demonstrated significant cardiac risk associated with aspirin withdrawal in patients with cardiac stents. Although it has recently been demonstrated that performing orthopedic surgery while continuing low-dose aspirin therapy seems to be safe, studies focused on spinal surgery have not yet been performed. Because of the risk of intraspinal bleeding and the serious consequences of subsequent epidural hematoma with associated spinal cord compression, spinal surgeons have been reluctant to operate on patients taking aspirin. **METHODS:** This institutional review board-approved study included 200 patients. Preoperative parameters and postoperative outcome measures were analyzed for 100 patients who underwent spinal surgery after the discontinuation of anticoagulation therapy and 100 patients who continued to take daily aspirin through the perioperative period. The primary outcome measure was serious bleeding-related postoperative complications such as spinal epidural hematoma. The operative time, intraoperative estimated blood loss, hospital length of stay, transfusion of blood products, and 30-day hospital readmission rates were also recorded and compared. **RESULTS:** The patients who continued taking aspirin in the perioperative period had a shorter hospital length of stay on average (4.1 +/- 2.7 vs. 6.2 +/- 5.8; P < 0.005), as well as a reduced operative time (210 +/- 136 vs. 266 +/- 143; P < 0.01), whereas there was no significant difference in the estimated blood loss (642 +/- 905 vs. 697 +/- 1187), the amount of blood products transfused, overall intra- and postoperative complication rate (8% vs. 11%), or 30-day hospital readmission rate (5% vs. 5%). No clinically significant spinal epidural hematomas were observed in either of the study groups. **CONCLUSION:** The current study has observed no appreciable increase in bleeding-related complication rates in patients with cardiac stents undergoing spine surgery while continuing to take aspirin compared with patients who discontinued aspirin prior to surgery. Although very large studies will be needed to determine whether aspirin administration results in a small complication rate increase, the current study provides evidence that perioperative aspirin therapy is relatively safe in patients undergoing spinal surgery. **LEVEL OF EVIDENCE:** 2.

PMID: 26030214
ISSN: 1528-1159

**International journal of spine surgery. 2015:10. DOI: 10.14444/3014**

**Analysis of postoperative thoracolumbar spine infections in a prospective randomized controlled trial using the Centers for Disease Control surgical site infection criteria**

McClelland, S, III; Takemoto, RC; Lonner, BS; Andres, TM; Park, JJ; Ricart-Hoffiz, PA; Bendo, JA; Goldstein, JA; Spivak, JM; Errico, TJ

**Introduction** Wound infections following spinal surgery place a high toll on both the patient and the healthcare system. Although several large series studies have examined the incidence and distribution of spinal wound infection, the applicability of these studies varies greatly since nearly every study is either retrospective and/or lacks standard inclusion criteria for defining surgical site infection. To
address this void, we present results from prospectively gathered thoracolumbar spine surgery data for which the Centers for Disease Control (CDC) criteria were stringently applied to define a surgical site infection (SSI). Methods A prospective randomized trial of 314 patients who underwent multilevel thoracolumbar spinal surgery with instrumentation followed by postoperative drain placement was completed (Takemoto et al., 2015). The trial consisted of two antibiotic arms: One for 24-hours, and the other for the duration of the drain; no differences were found between the arms. All infections meeting CDC criteria for SSI were included. Results A total of 40 infections met CDC criteria for SSI, for an overall incidence of 12.7%. Of these, 20 (50%) were culture-positive. The most common organism was Staphylococcus aureus (4 total: Methicillin-sensitive=2; methicillin-resistant=2), followed by coagulase-negative Staphylococcus (3 cases), Propionibacterium acnes and Escherichia coli (2 cases each). Six infections grew multiple organisms, most commonly involving coagulasenegative staphylococcus and enterococcus. Conclusions Our findings indicate that thoracolumbar SSI occurs at the higher end of the range cited in the literature (2-13%), which is largely based on retrospective data not subjected to the inclusivity of SSI as defined by the CDC. The three most common organisms in our analysis (S. aureus, P. acnes, E. coli) are consistent with previous reports. Staphylococcus aureus continues to be the most common causative organism and continued vigilance and searching for preventive measures need to be a high priority. This study provides Level I evidence

**Immunologic research. 2015;63(1-3):58-69.** DOI: [10.1007/s12026-015-8719-0](https://doi.org/10.1007/s12026-015-8719-0)

**Advancing drug delivery systems for the treatment of multiple sclerosis**
Tabansky, Inna; Messina, Mark D; Bangeranye, Catherine; Goldstein, Jeffrey; Blitz-Shabbir, Karen M; Machado, Suly; Jeganathan, Venkatesh; Wright, Paul; Najjar, Souhel; Cao, Yonghao; Sands, Warren; Keskin, Derin B; Stern, Joel N H

Multiple sclerosis (MS) is a chronic inflammatory autoimmune disease of the central nervous system. It is characterized by demyelination of neurons and loss of neuronal axons and oligodendrocytes. In MS, auto-reactive T cells and B cells cross the blood-brain barrier (BBB), causing perivenous demyelinating lesions that form multiple discrete inflammatory demyelinated plaques located primarily in the white matter. In chronic MS, cortical demyelination and progressive axonal transsections develop. Treatment for MS can be stratified into disease-modifying therapies (DMTs) and symptomatic therapy. DMTs aim to decrease circulating immune cells or to prevent these cells from crossing the BBB and reduce the inflammatory response. There are currently 10 DMTs approved for the relapsing forms of MS; these vary with regard to their efficacy, route and frequency of administration, adverse effects, and toxicity profile. Better drug delivery systems are being developed in order to decrease adverse effects, increase drug efficacy, and increase patient compliance through the direct targeting of pathologic cells. Here, we address the uses and benefits of advanced drug delivery systems, including nanoparticles, microparticles, fusion antibodies, and liposomal formulations. By altering the properties of therapeutic particles and enhancing targeting, breakthrough drug delivery technologies potentially applicable to multiple disease treatments may rapidly emerge.

PMID: 26475738
ISSN: 1559-0755


**Appropriateness of Twenty-four-Hour Antibiotic Prophylaxis After Spinal Surgery in Which a Drain Is Utilized: A Prospective Randomized Study**
Takemoto, Richelle C; Lonner, Baron; Andres, Tate; Park, Justin; Ricart-Hoffiz, Pedro; Bendo, John; Goldstein, Jeffrey; Spivak, Jeffrey; Errico, Thomas
BACKGROUND: Wound drains that are left in place for a prolonged period of time have a higher rate of bacterial contamination. Following spinal surgery, a drain is often left in place for a longer period of time if it maintains a high output. Given the major consequences of an infection following spinal surgery and the lack of data with regard to the use of antibiotics and drains, we performed a study of patients with a drain following spinal surgery to compare infection rates between those who were treated with antibiotics for twenty-four hours and those who received antibiotics for the duration for which the drain was in place.

METHODS: We performed a prospective randomized trial of 314 patients who underwent multilevel thoracolumbar spinal surgery followed by use of a postoperative drain. The patients were randomized into two groups, one of which received perioperative antibiotics for twenty-four hours (twenty-four-hour group) and the other of which received antibiotics for the duration that the drain was in place (drain-duration group). Data collected included demographic characteristics, medical comorbidities, type of spinal surgery, and surgical site infection.

RESULTS: Twenty-one (12.4%) of the 170 patients in the twenty-four-hour group and nineteen (13.2%) of the 144 in the drain-duration group developed a surgical site infection (p = 0.48). There were no significant differences between the twenty-four-hour and drain-duration groups with respect to demographic characteristics (except for the American Society of Anesthesiologists [ASA] classification), operative time, type of surgery, drain output, or length of hospital stay.

CONCLUSIONS: Continuing perioperative administration of antibiotics for the entire duration that a drain is in place after spinal surgery did not decrease the rate of surgical site infections.

LEVEL OF EVIDENCE: Therapeutic Level I. See Instructions for Authors for a complete description of levels of evidence.

PMID: 26085531
ISSN: 1535-1386

Does Choline PET/CT Change the Management of Prostate Cancer Patients With Biochemical Failure?

Goldstein, Jeffrey; Even-Sapir, Einat; Ben-Haim, Simona; Saad, Akram; Spieler, Benjamin; Davidson, Tima; Berger, Raanan; Weiss, Ilana; Appel, Sarit; Lawrence, Yaacov R; Symon, Zvi

PURPOSE: The FDA approved C-11 choline PET/computed tomography (CT) for imaging patients with recurrent prostate cancer in 2012. Subsequently, the 2014 NCCN guidelines have introduced labeled choline PET/CT in the imaging algorithm of patients with suspected recurrent disease. However, there is only scarce data on the impact of labeled choline PET/CT findings on disease management. We hypothesized that labeled-choline PET/CT studies showing local or regional recurrence or distant metastases will have a direct role in selection of appropriate patient management and improve radiation planning in patients with disease that can be controlled using this mode of therapy.

METHODS: This retrospective study was approved by the Tel Aviv Sourasky and Sheba Medical Center’s Helsinki ethical review committees. Patient characteristics including age, PSA, stage, prior treatments, and pre-PET choline treatment recommendations based on NCCN guidelines were recorded. Patients with biochemical failure and without evidence of recurrence on physical examination or standard imaging were offered the option of additional imaging with labeled choline PET/CT. Treatment recommendations post-PET/CT were compared with pre-PET/CT ones. Pathologic confirmation was obtained before prostate retreatment. A nonparametric chi test was used to compare the initial and final treatment recommendations following choline PET/CT.

RESULTS: Between June 2010 and January 2014, 34 labeled-choline PET/CT studies were performed on 33 patients with biochemical failure following radical prostatectomy (RP) (n=6), radiation therapy (RT) (n=6), brachytherapy (n=2), RP+salvage prostate fossa RT (n=14), and RP+salvage prostate fossa/lymph node RT (n=6). Median PSA level before imaging was 2 ng/mL (range, 0.16 to 79). Labeled choline PET/CT showed prostate, prostate fossa, or pelvic lymph node increased uptake in 17 studies, remote metastatic disease in 9 studies, and failed to identify the cause for biochemical failure in 7 scans. PET/CT altered treatment approach in 18 of
33 (55%) patients (P=0.05). Sixteen of 27 patients (59%) treated previously with radiation were retreated with RT and delayed or eliminated androgen deprivation therapy: 1 received salvage brachytherapy, 10 received salvage pelvic lymph node or prostate fossa irradiation, 2 brachytherapy failures received salvage prostate and lymph nodes IMRT, and 3 with solitary bone metastasis were treated with radiosurgery. Eleven of 16 patients retreated responded to salvage therapy with a significant PSA response (<0.2 ng/mL), 2 patients had partial biochemical responses, and 3 patients failed. The median duration of response was 500+/−447 days. Two of 6 patients with no prior RT were referred for salvage prostate fossa RT: 1 received dose escalation for disease identified in the prostate fossa and another had inclusion of “hot” pelvic lymph nodes in the treatment volume. CONCLUSIONS: These early results suggest that labeled choline PET/CT imaging performed according to current NCCN guidelines may change management and improve care in prostate cancer patients with biochemical failure by identifying patients for referral for salvage radiation therapy, improving radiation planning, and delaying or avoiding use of androgen deprivation therapy.

PMID: 25319322
ISSN: 1537-453x

Intraoperative spinal cord and nerve root monitoring: A pilot survey [Meeting Abstract]
Rattenni, R N; Cherian, T; Lee, A A; Bendo, J A; Errico, T J; Goldstein, J A
BACKGROUND CONTEXT: Intraoperative neuromonitoring (IOM) of spinal cord and nerve root injury through somatosensory evoked potentials (SSEP), transcranial motor evoked potentials (TcMEP), spontaneous electromyography (sEMG), and triggered electromyography (tEMG) modalities is vital during spinal surgery. However, there are currently no practice guidelines or practice patterns for the utilization of unimodal or multimodal IOM (MIOM) for specific spinal surgeries. PURPOSE: This pilot study documents practice patterns of IOM for select spinal procedures. STUDY DESIGN/SETTING: Questionnaire survey. PATIENT SAMPLE: 22 fellowship-trained spine surgeons, both surgeons and neurosurgeons, were queried on use of IOM modality combination in various spine procedures. Surgical experience varied from three to 29 years, with an average of 14.4 years. OUTCOME MEASURES: Percentage of surgeons using IOM modality or MIOM combination was calculated for each procedure. METHODS: Spine surgeons at two hospitals were surveyed on practice patterns of use of intraoperative monitoring for three deformity procedures and 21 non-deformity procedures. RESULTS: Of the 18 (81%) responses received: 15 from orthopaedic surgeons and 3 from neurosurgeons. Deformity Surgery: For both cervical and thoracic deformity surgeries, all surgeons used at least SSEP+TcMEP. For cervical surgeries, 47% of surgeons additionally used sEMG while for thoracic 71% of surgeons additionally used sEMG+tEMG. Most surgeons (44%) used all four modalities for lumbar deformity surgery. Non-Deformity surgery: For patients having radiculopathy undergoing ACDF, SSEP alone was utilized by 29%. However, in patients undergoing ACDF with symptoms of myelopathy, most surgeons (31%) used SSEP+TcMEP with only 13% using SSEP only. Forty-six percent of surgeons utilized SSEP+TcMEP+sEMG for cervical arthroplasty procedures. SSEP+TcMEP+sEMG was the most commonly used for posterior cervical laminoforaminotomy, posterior cervical laminectomy and posterior cervical laminect!
EMBASE:71675989
ISSN: 1529-9430

Spine journal. 2013:13(9):98S-98S.DOI:
Cost-effectiveness of lumbar spondylolisthesis surgery at two-year follow-up [Meeting Abstract]
Cassilly, R; Fischer, C R; Peters, A; Trimba, Y; Goldstein, J A; Spivak, J M; Bendo, J A
BACKGROUND CONTEXT: Comparative effectiveness as well as cost analysis research are gaining popularity within the field of spinal surgery. In general, prior studies have shown that surgical
interventions with a cost per Quality Adjusted Life Year (QALY) less than $100,000 are cost-effective for our society. Cost-effectiveness studies for surgical management of spondylolisthesis are lacking.

PURPOSE: The purpose of this study is to determine the cost/QALY of lumbar spondylolisthesis treated with multiple surgical techniques, and to identify preoperative factors that lead to cost-effectiveness at 2-year follow-up.

STUDY DESIGN/SETTING: Retrospective analysis of prospectively collected data.

PATIENT SAMPLE: Patients who underwent surgery for degenerative or isthmic spondylolisthesis at a single institution from 2009-2011. OUTCOME MEASURES: Oswestry Disability Index, change in QALY, cost/QALY.

METHODS: We performed a retrospective analysis of prospectively collected data on 44 patients who underwent surgery for degenerative or isthmic spondylolisthesis. There were 30 cases of degenerative and 14 cases of isthmic spondylolisthesis. There were 27 women and 17 men, with an average age at surgery of 59.7 years old (SD 14.8). The change in QALY was determined from the 2-year outcome scores using EuroQol-5D. Outcomes were also assessed using the Oswestry Disability Index (ODI). Hospital DRG codes were used to assess Medicare based hospital costs. Surgical, neuromonitoring, and anesthesia CPT codes were used to determine additional direct care costs of surgery. Analysis was performed to determine which factors were associated with a cost/QALY less than $100,000, thereby making the procedure cost-effective. Statistical analysis was performed using ANOVA, Chi Square, and linear regression analysis.

RESULTS: The average length of follow up was 2 years (SD 0.82). The average postoperative improvement in ODI was 24.5 (SD 23.9) and change in QALY was 0.4449 (SD 0.2984). The average cost/QALY at 2-year follow-up was $17,734 for CLP and $37,413 for CLF (P < .01). Mean HCh for CLP was 42% of that for CLF, and therefore the mean charge for CLF was 238% of that for CLP (P < .01). Mean HC was $15,426 for CLP and $32,125 for CLF (P < .01); the main contributor was implant cost (mean $2582). CONCLUSIONS: Our study demonstrates that, in clinically similar populations, CLP results in reduced length of stay, TC, and hospital charges. In CSM cases requiring posterior decompression, we demonstrate CLP to be a less costly procedure. However, in the presence of neck pain, kyphotic deformity, or gross instability, this procedure may not be sufficient and posterior CLF may be required.
Cost-utility analysis modeling at 2-year follow-up for cervical disc arthroplasty versus anterior cervical discectomy and fusion: A single-center contribution to the randomized controlled trial

Warren, Daniel; Andres, Tate; Hoelscher, Christian; Ricart-Hoffiz, Pedro; Bendo, John; Goldstein, Jeffrey

BACKGROUND: Patients with cervical disc herniations resulting in radiculopathy or myelopathy from single level disease have traditionally been treated with Anterior Cervical Discectomy and Fusion (ACDF), yet Cervical Disc Arthroplasty (CDA) is a new alternative. Expert suggestion of reduced adjacent segment degeneration is a promising future result of CDA. A cost-utility analysis of these procedures with long-term follow-up has not been previously reported. METHODS: We reviewed single institution prospective data from a randomized trial comparing single-level ACDF and CDA in cervical disc disease. Both Medicare reimbursement schedules and actual hospital cost data for peri-operative care were separately reviewed and analyzed to estimate the cost of treatment of each patient. QALYs were calculated at 1 and 2 years based on NDI and SF-36 outcome scores, and incremental cost effectiveness ratio (ICER) analysis was performed to determine relative cost-effectiveness. RESULTS: Patients of both groups showed improvement in NDI and SF-36 outcome scores. Medicare reimbursement rates to the hospital were $11,747 and $10,015 for ACDF and CDA, respectively; these figures rose to $16,162 and $13,171 when including physician and anesthesiologist reimbursement. The estimated actual cost to the hospital of ACDF averaged $16,108, while CDA averaged $16,004 (p = 0.97); when including estimated physicians fees, total hospital costs came to $19,811 and $18,440, respectively. The cost/QALY analyses therefore varied widely with these discrepancies in cost values. The ICERs of ACDF vs CDA with Medicare reimbursements were $18,593 (NDI) and $19,940 (SF-36), while ICERs based on actual total hospital cost were $13,710 (NDI) and $9,140 (SF-36). CONCLUSIONS: We confirm the efficacy of ACDF and CDA in the treatment of cervical disc disease, as our results suggest similar clinical outcomes at one and two year follow-up. The ICER suggests that the non-significant added benefit via ACDF comes at a reasonable cost, whether we use actual hospital costs or Medicare reimbursement values, though the actual ICER values vary widely depending upon the CUA modality used. Long term follow-up may illustrate a different profile for CDA due to reduced cost and greater long-term utility scores. It is crucial to note that financial modeling plays an important role in how economic treatment dominance is portrayed.
Blocked randomization was performed with use of a 2:1 ratio of total disc arthroplasty to circumferential arthrodesis. Evaluations, including patient self-assessments, physical and neurological examinations, and radiographic examinations, were performed preoperatively, six weeks postoperatively, and three, six, twelve, eighteen, and twenty-four months postoperatively. RESULTS: At twenty-four months, 58.8% (eighty-seven) of 148 patients in the total disc replacement group were classified as a statistical success, compared with 47.8% (thirty-two) of sixty-seven patients in the arthrodesis group; non-inferiority was demonstrated. The mean Oswestry Disability Index in both groups significantly improved from baseline (p < 0.0001); the mean percentage improvement for the total disc replacement group was significantly better than that for the arthrodesis group (p = 0.0282). An established clinical criterion for success, a ≥15-point improvement in the Oswestry Disability Index from baseline, occurred in 73.2% (109) of 149 patients in the total disc replacement group and 59.7% (thirty-seven) of sixty-two patients in the arthrodesis group. The Short Form-36 physical component scores were significantly better for the total disc replacement group as compared with the arthrodesis group (p = 0.0141 at twenty-four months). Visual analog scale scores for satisfaction significantly favored total disc replacement from three to twenty-four months. At twenty-four months, 78.2% (111) of 142 patients in the total disc replacement group and 62.1% (thirty-six) of fifty-eight patients in the arthrodesis group responded "yes" when asked if they would have the same surgery again. Lumbar spine range of motion on radiographs averaged 7.8 degrees at the superior disc and 6.2 degrees at the inferior disc in patients with total disc replacement. Reduction in narcotics usage significantly favored the total disc replacement group at twenty-four months after surgery (p = 0.0020). CONCLUSIONS: Despite the relatively short duration of follow-up and design limitations, the present study suggests that two-level lumbar disc arthroplasty is an alternative to and offers clinical advantages in terms of pain relief and functional recovery in comparison with arthrodesis. Longer-term follow-up is needed to determine the risks for implant wear and/or degenerative segment changes.
PMID: 21398574
ISSN: 1535-1386

Circulation: Cardiovascular interventions. 2011;4(5):429-437.DOI:

Detection of lipid-core plaques by intracoronary near-infrared spectroscopy identifies high risk of periprocedural myocardial infarction

Background-Percutaneous coronary intervention (PCI) is associated with periprocedural myocardial infarction (MI) in 3% to 15% of cases (depending on the definition used). In many cases, these MIs result from distal embolization of lipid-core plaque (LCP) constituents. Prospective identification of LCP with catheter-based near-infrared spectroscopy (NIRS) may predict an increased risk of periprocedural MI and facilitate development of preventive measures. Methods and Results-The present study analyzed the relationship between the presence of a large LCP (detected by NIRS) and periprocedural MI. Patients with stable preprocedural cardiac biomarkers undergoing stenting were identified from the COLOR Registry, an ongoing prospective observational study of patients undergoing NIRS before PCI. The extent of LCP in the treatment zone was calculated as the maximal lipid-core burden index (LCBI) measured by NIRS for each of the 4-mm longitudinal segments in the treatment zone. A periprocedural MI was defined as new cardiac biomarker elevation above 3 x upper limit of normal. A total of 62 patients undergoing stenting met eligibility criteria. A large LCP (defined as a maxLCBI<sub>4</sub>mm >= 500) was present in 14 of 62 lesions (22.6%), and periprocedural MI was documented in 9 of 62 (14.5%) of cases. Periprocedural MI occurred in 7 of 14 patients (50%) with a maxLCBI<sub>4</sub>mm >= 500, compared with 2 of 48 patients (4.2%) patients with a lower maxLCBI<sub>4</sub>mm (P=0.0002).
Conclusions-NIRS provides rapid, automated detection of extensive LCPs that are associated with a high risk of periprocedural MI, presumably due to embolization of plaque contents during coronary intervention. 2011 American Heart Association, Inc
EMBASE:201169951
ISSN: 1941-7640

Spine journal. 2011;11(10 SUPPL 1):82S-82S. DOI:
Cost-utility analysis of anterior cervical discectomy and fusion versus cervical disc arthroplasty
[Meeting Abstract]
Hoelscher C.; Warren D.; Ricart-Hoffiz P.; Bendo J.; Goldstein J.
BACKGROUND CONTEXT: Patients with cervical disc herniations resulting in radiculopathy or myelopathy from single level disease have traditionally been treated with Anterior Cervical Discectomy and Fusion (ACDF) with excellent results. Cervical Disc Arthroplasty (CDA) has been shown to result in similar clinical outcomes. Expert suggestion of reduced adjacent segment degeneration is a promising future result. A Cost-Utility Analysis of these procedures with long-term follow-up has not been previously reported. PURPOSE: To compare the cost-utility of ACDF vs. CDA in single level cervical disc disease. To structure future research of the cost-utility over a long term follow-up for these alternative surgical options. STUDY DESIGN/SETTING: Single institution review of a randomized controlled trial comparing ACDF to CDA in the setting of single level cervical disc disease with the performance of a cost-utility analysis. PATIENT SAMPLE: 28 patients (ACDF n=510, CDA n=518) who underwent surgery as part of a randomized controlled trial. OUTCOME MEASURES: Clinical outcome scores (neck disability index, SF-36) and direct treatment costs. METHODS: We reviewed single institution prospective data from a randomized trial comparing single-level ACDF and CDA in cervical disc disease. Data collected included demographics, outcome scores (NDI and SF-36), and utility scores. Procedural cost was estimated via medicare reimbursement based on DRG and physician CPT codes. QALYs were calculated at 1 and 2 years after surgery, allowing for cost/QALY assessments. RESULTS: Patients included ACDF (n=510) and CDA (n=518) with no significant difference in demographic data. Both groups showed improvement in NDI. Both groups showed improvement in all domains of SF-36 except general health (GH), which remained stable. ACDF patients recorded significantly higher scores in the mental health (MH) domain at 1 and 2 years (p<.05). At two years, total QALYs gained were 0.42 and 0.26 for ACDF and CDA respectively. The average cost of ACDF was $16,162, while CDA averaged $13,187. Cost/QALY was $38,480 and $50,719 for ACDF and CDA at 2 years. The incremental cost effectiveness ratio (ICER) of ACDF vs CDA was $18,593. CONCLUSIONS: We confirm the efficacy of ACDF and CDA in the treatment of cervical disc disease. Our results suggest similar clinical outcomes at one and two year follow-up. Both modalities demonstrate cost-effectiveness. However, the additional QALYs gained by ACDF in this study demonstrate a potentially more cost-effective profile at two years. The ICER suggests that the added benefit via ACDF comes at a cost. Long term follow-up may illustrate greater cost effectiveness via CDA due to reduced cost and potential economic treatment dominance over ACDF
EMBASE:70558254
ISSN: 1529-9430

The Incidence of Potential Candidates for Total Disc Replacement among Lumbar and Cervical Fusion Patient Populations
Quirno, Martin; Goldstein, Jeffrey A; Bendo, John A; Kim, Yong; Spivak, Jeffrey M
STUDY DESIGN: Retrospective chart review. PURPOSE: To evaluate the incidence of potential total disc replacement (TDR) candidates among cervical and lumbar fusion patient populations using strict Food and Drug Administration (FDA) criteria and with relative exclusion criteria removed. OVERVIEW OF
LITERATURE: Recent studies suggest that the potential percentage of patients that are candidates for TDR ranges from 0-5% in lumbar fusions and 43% in cervical fusions. METHODS: We performed a retrospective chart review of 280 consecutive patients who had lumbar (n = 174) and cervical (n = 106) fusion or TDR performed by one of four independent adult orthopaedic spine surgeons. Charts were screened for investigational device exemption (IDE) inclusion/exclusion criteria and later reanalyzed excluding relative exclusion criteria, such as history of chronic medical illness, twodle disease (cervical cases), and history of prior fusion surgery in the anatomic region. RESULTS: Of the 174 lumbar surgeries, 10 were TDR with Prodisc-L and 164 were lumbar fusions. The most common TDR exclusion criteria were lytic spondylolisthesis or spinal stenosis (47.7% of patients) and more than 2 level degenerative disc disease (37.9%). 14.9% had no IDE exclusion criteria and would be considered candidates for TDR. After excluding the relative lumbar exclusion criteria, this percentage increased to 25.8%. Of the 106 cervical cases, 3 had a TDR with Prodisc-C and 103 had a cervical fusion. Twenty eight percent had no IDE exclusion criteria and would be considered candidates for cervical TDR. CONCLUSIONS: A larger percentage of cervical fusion candidates are potential candidates for TDR (28%) than lumbar fusion candidates (14.9%) based on the strict IDE criteria.

Bulletin of the NYU Hospital for Joint Diseases. 2011;69(4):316-319. DOI:

Outcomes analysis of anterior-posterior fusion for low grade isthmic spondylolisthesis
Quirino, Martin; Kamerlink, Jonathan R; Goldstein, Jeffrey A; Spivak, Jeffrey M; Bendo, John A; Errico, Thomas J

BACKGROUND: Traditional surgical treatment of isthmic spondylolisthesis is posterior-lateral fusion, but the addition of anterior surgery has been explored. The purpose of this study was to evaluate the surgical and clinical outcomes of anterior-posterior surgical treatment for low-grade isthmic spondylolisthesis. METHODS: Retrospectively, we enrolled 23 consecutive patients (mean age of 50) who underwent surgical treatment for low grade isthmic spondylolisthesis. The mean follow-up was 10 months. Basic demographic and radiographic data was collected. Pre- and post-surgical clinical surveys (VAS, ODI, and SF-36) were collected. RESULTS: All 23 patients underwent anterior interbody fusion with a femoral ring allograft or ICBG in combination with posterior lumbar decompression and fusion with instrumentation. The average slip percentage decreased from 23.2% to 19.0% (p = 0.24) while slip angle increased from 9.8 degrees to 17.9 degrees (p < 0.001) and average disc height decreased from 1.9 cm to 0.80 cm (p < 0.001). VAS scores decreased from 7.1 to 2.4 (p < 0.001), ODI scores decreased from 52.5 to 28.1 (p < 0.001), and SF-36 scores increased in the Physical Component Scale (PCS) from 29.5 to 42.6 (p < 0.001). CONCLUSION: In our study, patients demonstrated an improvement in the ODI as well the physical component scores of the SF-36, thus having a good clinical outcome.

PMID: 22196389
ISSN: 1936-9719

Bulletin of the NYU Hospital for Joint Diseases. 2011;69(4):298-302. DOI:

Biomechanical comparison of translaminar screw versus pedicle screw supplementation of anterior femoral ring allografts in one-level lumbar spine fusion
Razi, Afshin E; Spivak, Jeffrey M; Kummer, Frederick J; Hersh, David S; Goldstein, Jeffrey A

Pedicle screws (PS) can provide initial stabilization of anterior interbody femoral ring allograft (FRA) lumbar constructs. Translaminar screws (TLS) have also been advocated for this procedure. The objective of this study was to use an in vitro human cadaveric model to compare the stability of one-level anterior interbody lumbar constructs stabilized with PS and those stabilized with TLS. Five human
cadaveric spinal motion segments (L4-S2) were biomechanically evaluated in the intact condition and using the follow ing methods of stabilization: anterior interbody fusion with FRA, anterior FRA supplemented with PS, and anterior FRA supplemented with TLS. Stability was determined for each construct by measuring construct displacement as a function of applied load under the following conditions: compression, flexion, extension, lateral bending to each side, and axial torsion. There were no statistically significant differences in construct stability between FRA supplemented with PS and FRA supplemented with TLS under any of the loading conditions. In selected cases, supplementation of anterior femoral ring allograft with translaminar screws is a viable alternative to supplementation with pedicle screws.

PMID: 22196385
ISSN: 1936-9719

Spine journal. 2011:11(10 SUPPL 1):23S-23S. DOI:
Prospective, randomized study of surgical site infections with the use of perioperative antibiotics for 24 hours versus the duration of a drain after spinal surgery [Meeting Abstract]
Ricart-Hoffiz P.; Takemoto R.; Park J.; Andres T.; Hoelscher C.; Goldstein J.; Spivak J.; Bendo J.; Errico T.; Lonner B.

BACKGROUND CONTEXT: The use of a postoperative spinal drain for spine surgery patients is widely thought to increase the risk of postoperative infection. While antibiotics are commonly given postoperatively to decrease bacterial seeding of the hematoma, the duration of postoperative antibiotics is more debatable, and protocols may vary. PURPOSE: To determine if the continuation of postoperative antibiotics for the duration of the time a spinal drain is in place reduces the risk of acute surgical site infection, in comparison with postoperative antibiotics given for 24 hours only. STUDY DESIGN/SETTING: Prospective, randomized double-blind study. PATIENT SAMPLE: Patients undergoing multilevel thoracolumbar spine surgery in which a drain is used. OUTCOME MEASURES: Surgical site infections were defined as purulent drainage; organisms obtained from an aseptically obtained culture; pain, swelling and redness; and/or diagnosis of infection by a surgeon. METHODS: 315 patients who underwent multilevel thoracolumbar spine surgery requiring a postoperative drain were enrolled and randomized into two groups: one group receiving 24 hours of perioperative antibiotics and one group receiving antibiotics for the duration that the drain was in place. Data collected included demographics, medical co-morbidities, type of spine surgery and surgical site infection. RESULTS: 13/170 (7.6%) in the 24 hours of antibiotic group developed a surgical site infection while 21/145 (14.5%) in the antibiotic for the duration of the drain were found to have a surgical site infection. The differences between each group were significant (p<.05). There were no significant differences between the groups with respect to demographics, surgical time, type of surgery, drain output or length of stay. CONCLUSIONS: Continuing postoperative antibiotics for the entire duration a drain is in place after spine surgery does not decrease the rate of surgical site infections

EMBASE:70558137
ISSN: 1529-9430


Cost-utility analysis of anterior cervical discectomy and fusion versus cervical disc arthroplasty
Warren, Daniel; Hoelscher, Christian; Ricart-Hoffiz, Pedro; Bendo, John; Goldstein, Jeffrey

PMCID:3604757
PMID: 23526900
ISSN: 1663-7976
Results at 24 months from the prospective, randomized, multicenter Investigational Device Exemption trial of ProDisc-C versus anterior cervical discectomy and fusion with 4-year follow-up and continued access patients

Delamarter R.B.; Murrey D.; Janssen M.E.; Goldstein J.A.; Zigler J.; Tay B.K.-B.; Darden B.

Background: Cervical total disk replacement (TDR) is intended to address pain and preserve motion between vertebral bodies in patients with symptomatic cervical disk disease. Two-year follow-up for the ProDisc-C (Synthes USA Products, LLC, West Chester, Pennsylvania) TDR clinical trial showed non-inferiority versus anterior cervical discectomy and fusion (ACDF), showing superiority in many clinical outcomes. We present the 4-year interim follow-up results. Methods: Patients were randomized (1:1) to ProDisc-C (PDC-R) or ACDF. Patients were assessed preoperatively, and postoperatively at 6 weeks and 3, 6, 12, 18, 24, 36, and 48 months. After the randomized portion, continued access (CA) patients also underwent ProDisc-C implantation, with follow-up visits up to 24 months. Evaluations included Neck Disability Index (NDI), Visual Analog Scale (VAS) for pain/satisfaction, and radiographic and physical/neurologic examinations. Results: Randomized patients (103 PDC-R and 106 ACDF) and 136 CA patients were treated at 13 sites. VAS pain and NDI score improvements from baseline were significant for all patients (P < .0001) but did not differ among groups. VAS satisfaction was higher at all time points for PDC-R versus ACDF patients (P = .0499 at 48 months). The percentage of patients who responded yes to surgery again was 85.6% at 24 months and 88.9% at 48 months in the PDC-R group, 80.9% at 24 months and 81.0% at 48 months in the ACDF group, and 86.3% at 24 months in the CA group. Five PDC-R patients (48 months) and no CA patients (24 months) had index-level bridging bone. By 48 months, approximately 4-fold more ACDF patients required secondary surgery (3 of 103 PDC-R patients [2.9%] vs 12 of 106 ACDF patients [11.3%], P = .0292). Of these, 6 ACDF patients (5.6%) required procedures at adjacent levels. Three CA patients required secondary procedures (24 months). Conclusions: Our 4-year data support that ProDisc-C TDR and ACDF are viable surgical options for symptomatic cervical disk disease. Although ACDF patients may be at higher risk for additional surgical intervention, patients in both groups show good clinical results at longer-term follow-up. 2010 Elsevier Inc

Analysis of segmental cervical spine vertebral motion after prodisc-C cervical disc replacement

Park, Justin J; Quirno, Martin; Cunningham, Mary R; Schwarzkopf, Ran; Bendo, John A; Spivak, Jeffrey M; Goldstein, Jeffrey A

STUDY DESIGN: Retrospective study of patients enrolled in a prospective randomized Food and Drug Administration trial with single level cervical disc replacement (CDR) with the ProDisc-C (Synthes, Paoli, PA). OBJECTIVE: Evaluate the segmental range of motion (ROM) in the cervical spine pre- and postoperative after CDR. SUMMARY OF BACKGROUND INFORMATION: Each cervical level is believed to have its own biomechanical characteristics, ultimately leading to different sagittal and lateral ROM. Our understanding of the factors that influence motion after CDR continues to change and expand.

METHODS: One hundred sixty-four patients with single level ProDisc-C arthroplasty were evaluated radiographically using Medical Metrics (QMATM, Medical Metrics, Inc., Houston, TX). Pre- and postoperative disc height and ROM were measured from standing lateral and flexion-extension radiographs. Of these 164 patients, 44 had a CDR at C6/C7, 96 at C5/C6, 18 at C4/C5, and 6 at C3/C4. The mean follow-up was of 24 months. Statistical analysis evaluated the difference in mean ROM between the groups. RESULTS: Before surgery, C4/C5 had more sagittal ROM compared with C3/C4, C5/C6, and C6/C7 (P < 0.001.) Before surgery, C4/C5 also had more lateral ROM compared with C3/C4, C5/C6, and C6/C7 (P = 0.015). After surgery, there were no significant differences in sagittal and lateral
ROM between C3/C4, C4/C5, C5/C6, and C6/C7. The delta (difference between pre- and postoperative) proved that the C4/C5 CDR actually lost sagittal ROM (-2.5 degrees ) compared with the other levels, which gained sagittal ROM, C3/C4 (0.9 degrees ), C5/C6 (1.8 degrees ), and C6/C7 (1.6 degrees ); P = 0.037. There was no significant difference in the delta lateral ROM between the segments: C3/C4, C4/C5, C5/C6, and C6/C7. CONCLUSION: CDR approximates the different segmental sagittal and lateral ROM. Although C4/C5 had negative delta ROM in the sagittal and lateral planes, it provided a satisfactory final ROM. Long-term clinical outcome studies are needed to properly evaluate if these differences could ultimately affect the patients everyday life

PMID: 20354472
ISSN: 1528-1159

Spine journal. 2010:10(5):CP3-CP3. DOI:
Effect of intervertebral disc height on postoperative motion and clinical outcomes after Prodisc-C cervical disc replacement. (vol 9, pg 551, 2009) [Correction]
Peng, Chan WB; Quirno, Martin; Bendo, John A; Spivak, Jeffrey M; Goldstein, Jeffrey A

ISI:000278039300001
ISSN: 1529-9430

Endocrine reviews. 2010:31(3):S40-S40. DOI:
Endometrial Safety and Clinical Pharmacokinetics of an Ultra-Low Dose Estradiol Vaginal Tablet for Treatment of Menopausal Women with Vaginal Atrophy [Meeting Abstract]
Simon, James; Gut, Robert; Goldstein, Jeffrey; Germak, John; Nachtigall, Lila

ISI:000281989400040
ISSN: 0163-769x

Pain practice. 2009:9:67-68. DOI:
Outcome analysis of anterioposterior surgical technique for the treatment of low grade lumbar isthmic spondylolisthesis through standardized surveys [Meeting Abstract]
Kamerlink J.; Quirno M.; Goldstein J.; Spivak J.; Bendo J.; Errico T.
Introduction: The gold standard for the treatment of isthmic spondylolisthesis is posterior-lateral fusion. Few studies have evaluated the clinical outcomes of circumference fusion in the treatment if isthmic spondylolisthesis. The purpose of this study was to evaluate the surgical and clinical outcomes of anterior-posterior surgical treatment for low-grade isthmic spondylolisthesis. Methods: Retrospectively, 23 consecutive patients were enrolled that underwent surgical treatment for Isthmic Spondylolisthesis Grade 1 or 2. Basic demographic data was collected. Radiographic data that was collected included Meyerding Scale, disc height, and slip angle. Pre and post surgical clinical surveys which included VAS, ODI, and SF-36 surveys were collected. Results: There were 23 patients. All patients underwent anterior interbody fusion with a femoral ring allograft or iliac crest bone graft in addition to posterior lumbar decompression and fusion with instrumentation. The average slip percentage decreased from 23.2% to 19.0% (P = 0.24), slip angle increased from 9.8 to 17.9 (P < 0.001), and disc height decreased from 1.9 cm to 0.80 cm (P < .001). VAS scores decreased from 7.1 to 2.4 (P < 0.001). ODI scores decreased from 52.5 to 28.1 (P < 0.001). SF-36 scores demonstrated a significant increase in the Physical Component Scale (PCS) from 29.5 to 42.6 (P < 0.001). Conclusion: This study demonstrates that patients with isthmic spondylolisthesis that undergo circumferential fusion have a good clinical outcome. Patients demonstrated an improvement in the ODI and the physical component scores of the SF-36. These results demonstrate that patients improved in their physical functioning due to the surgery alone.
Perioperative outcomes of anterior lumbar surgery in obese versus non-obese patients

Peng, Chan W B; Bendo, John A; Goldstein, Jeffrey A; Nalbandian, Matthew M

BACKGROUND CONTEXT: Anterior lumbar surgery is a common procedure for anterior lumbar interbody fusion and disc replacement but the impact of obesity on this procedure has not been determined.

PURPOSE: To assess the perioperative outcomes of anterior retroperitoneal lumbar surgery in obese versus non-obese patients.

STUDY DESIGN/SETTING: Prospective review of patients with anterior retroperitoneal lumbar disc procedures performed were evaluated.

PATIENT SAMPLE: Seventy-four patients with anterior retroperitoneal lumbar disc procedures were prospectively analyzed.

OUTCOME MEASURES: Outcome measures included complications attributable to the anterior procedure, analgesic use, length of time to ambulation, and length of hospitalization.

METHODS: Seventy-four anterior retroperitoneal lumbar disc procedures were prospectively analyzed.

Patient age, sex, body mass index, comorbidities, diagnosis, and operative parameters were collected. Access-related parameters and outcome measures were compared between obese and non-obese patients. Obesity was defined as body mass index greater than or equal to 30.

RESULTS: There were 35 males and 39 females. Mean age was 46.6 years. The main diagnosis (63.5%) was discogenic back pain. Forty-one (55%) patients were non-obese and 33 were obese. The two patient groups were comparable in terms of age, sex, diagnosis, mean number of anterior levels operated, and previous abdominal surgery (all p>.05). In obese patients, there were two iliac vein lacerations (major complication rate, 6.1%), one superficial infection, and one urinary tract infection (minor complication rate, 6.1%). In non-obese patients, there were two iliac vein lacerations, one intestinal serosal tear (major complication rate, 7.3%), and two urinary tract infections (minor complication rate, 4.9%). There was no significant difference in the complication rates between obese and non-obese patients (p=.6).

Obese patients have significantly longer duration of anterior exposure, duration of entire anterior surgery, longer length of anterior incision, and more depth from skin to fascia and from fascia to spine compared with non-obese patients. However, obesity does not affect blood loss, analgesic use, length of time to ambulation, and length of hospitalization.

CONCLUSION: Perioperative outcomes in obese and non-obese patients were comparable and obesity is not related to an increased risk of morbidity in anterior lumbar surgery.

PMID: 19525153
ISSN: 1878-1632
assessed. METHODS: Preoperative and postoperative disc height and ROM were measured from lateral and flexion-extension radiographs. Student t test and Spearman's rho tests were performed to determine any correlation or 'threshold' effect between the disc height and ROM or clinical outcome. RESULTS: Patients with less than 4mm of preoperative disc height had a mean 1.8 degrees increase in flexion-extension ROM after TDR, whereas patients with greater than 4mm of preoperative disc height had no change (mean, 0 degrees ) in flexion-extension ROM (p=.04). Patients with greater than 5mm of postoperative disc height have significantly higher postoperative flexion-extension ROM (mean, 10.1 degrees ) than those with less than 5mm disc height (mean, 8.3 degrees , p=.014). However, patients with greater than 7mm of postoperative disc height have significantly lower postoperative lateral bending ROM (mean, 4.1 degrees ) than those with less than 7mm disc height (mean, 5.7 degrees , p=.04). It appears that the optimal postoperative disc height is between 5 and 7mm for increased ROM on flexion extension and lateral bending. There was a mean improvement of 30.5 points for NDI, 4.3 points for VAS neck pain score, and 3.9 points for VAS arm pain score (all p<.001). No correlation could be found between clinical outcomes and disc height. Similarly, no threshold effect could be found between any specific disc height and NDI or VAS. CONCLUSION: Patients with greater disc collapse of less than 4mm preoperative disc height benefit more in ROM after TDR. The optimal postoperative disc height range to maximize ROM is between 5 and 7mm. This optimal range did not translate into better clinical outcome at 2-year follow-up
PMID: 19447077
ISSN: 1878-1632

A comparison of two retroperitoneal surgical approaches for total disc arthroplasty of the lumbar spine
Bendo, John A; Quirno, Martin; Errico, Thomas; Spivak, Jeffrey M; Goldstein, Jeffrey
STUDY DESIGN: Retrospective outcome data analysis. OBJECTIVE: To evaluate if there is a significant difference between the midline rectus (MR) and the paramedian lateral rectus (PLR) approaches with regard to implant position for lumbar disc arthroplasty. To establish that a less than optimal implant position may influence clinical outcome. SUMMARY OF BACKGROUND DATA: Little is known about the impact of varying surgical approaches on lumbar artificial disc implant position and clinical outcome. METHODS: Fifty-seven patients were obtained from one center participating Food and Drug Administration study for the evaluation of the lumbar Prodisc-L. Two different surgical access techniques were compared; the MR and left PLR. Two independent evaluators calculated the postoperative radiographical displacement from the midline in the coronal and sagittal planes for each of the surgical techniques. Pre- and postoperative clinical outcomes were evaluated to determine which surgical access technique was associated with better outcomes and if there was a clinical correlation with technical accuracy. RESULTS: The PLR approach was associated with greater malalignment of the prosthesis in both the coronal and sagittal planes compared with the MR approach. However, the difference was significant only in the sagittal plane (P = 0.021). There was no significant difference in clinical outcome for either approach (P = 0.34). Patients with >or=5 mm prosthetic displacement from the midvertebral point had significantly worse Oswestry disability index scores than patients with <3 mm malalignment in both the coronal and sagittal planes regardless of the surgical approach employed. CONCLUSION: The finding of a statistically significant more anteriorly displaced position in the sagittal plane of the total disc arthroplasty using the PLR approach may indicate a need to change to the MR approach. This study also demonstrates that patients with >or=5 mm prosthetic deviation from midline in either the coronal or sagittal planes had diminished clinical outcomes regardless of the approach used
PMID: 18197108
ISSN: 1528-1159
Results of the prospective, randomized, controlled multicenter Food and Drug Administration investigational device exemption study of the ProDisc-C total disc replacement versus anterior discectomy and fusion for the treatment of 1-level symptomatic cervical disc disease

Murrey, Daniel; Janssen, Michael; Delamarter, Rick; Goldstein, Jeffrey; Zigler, Jack; Tay, Bobby; Darden, Bruce

BACKGROUND CONTEXT: Cervical total disc replacement (TDR) is intended to address radicular pain and preserve functional motion between two vertebral bodies in patients with symptomatic cervical disc disease (SCDD). PURPOSE: The purpose of this trial is to compare the safety and efficacy of cervical TDR, ProDisc-C (Synthes Spine Company, L.P., West Chester, PA), to anterior cervical discectomy and fusion (ACDF) surgery for the treatment of one-level SCDD between C3 and C7. STUDY DESIGN/SETTING: The study was conducted at 13 sites. A noninferiority design with a 1:1 randomization was used.

PATIENT SAMPLE: Two hundred nine patients were randomized and treated (106 ACDF; 103 ProDisc-C).

OUTCOME MEASURES: Visual analog scale (VAS) pain and intensity (neck and arm), VAS satisfaction, neck disability index (NDI), neurological exam, device success, adverse event occurrence, and short form-36 (SF-36) standardized questionnaires.

METHODS: A prospective, randomized, controlled clinical trial was performed. Patients were enrolled and treated in accordance with the US Food and Drug Administration (FDA)-approved protocol. Patients were assessed pre- and postoperatively at six weeks, 3, 6, 12, 18, and 24 months.

RESULTS: Demographics were similar between the two patient groups (ProDisc-C: 42.1+/-8.4 years, 44.7% males; Fusion: 43.5 +/- 7.1 years, 46.2% males). The most commonly treated level was C5-C6 (ProDisc-C: 56.3%; Fusion:57.5%). NDI and SF-36 scores were significantly less compared with presurgery scores at all follow-up visits for both the treatment groups (p<.0001). VAS neck pain intensity and frequency as well as VAS arm pain intensity and frequency were statistically lower at all follow-up timepoints compared with preoperative levels (p<.0001) but were not different between treatments. Neurologic success (improvement or maintenance) was achieved at 24 months in 90.9% of ProDisc-C and 88.0% of Fusion patients (p=.638). Results show that at 24 months postoperatively, 84.4% of ProDisc-C patients achieved a more than or equal to 4 degrees of motion or maintained motion relative to preoperative baseline at the operated level. There was a statistically significant difference in the number of secondary surgeries with 8.5% of Fusion patients needing a re-operation, revision, or supplemental fixation within the 24 month postoperative period compared with 1.8% of ProDisc-C patients (p=.033). At 24 months, there was a statistically significant difference in medication usage with 89.9% of ProDisc-C patients not on strong narcotics or muscle relaxants, compared with 81.5% of Fusion patients.

CONCLUSIONS: The results of this clinical trial demonstrate that ProDisc-C is a safe and effective surgical treatment for patients with disabling cervical radiculopathy because of single-level disease. By all primary and secondary measures evaluated, clinical outcomes after ProDisc-C implantation were either equivalent or superior to those same clinical outcomes after Fusion.

PMID: 18774751
ISSN: 1878-1632

Effect of intervertebral disc height on postoperative motion and outcomes after ProDisc-L lumbar disc replacement

Yaszay, Burt; Bendo, John A; Goldstein, Jeffrey A; Quirno, Martin; Spivak, Jeffrey M; Errico, Thomas J

STUDY DESIGN: Retrospective study of patients enrolled in prospective randomized Food and Drug Administration trial. OBJECTIVE: To evaluate the influence of pre- and postoperative disc height on postoperative motion and clinical outcomes.

SUMMARY OF BACKGROUND DATA: Our understanding of the factors that influence motion and ultimately patient satisfaction after lumbar disc replacement...
continues to evolve. METHODS: Forty-two patients with a single level ProDisc-L at either the L4/5 or L5-S1 were selected. Pre- and postoperative disc height and range of motion (ROM) were measured from standing lateral and flexion-extension radiographs. Oswestry Disability Index and visual analog scale were also collected. Student t test and Spearman rho tests were performed to determine if there was any correlation or 'threshold' effect between the disc height and ROM or clinical outcome. RESULTS: The mean anterior and posterior disc height significantly increased from 10.8 mm to 17.6 mm and 4.4 mm to 7.9 mm, respectively (P < 0.01). The mean ROM decreased from 7.0 degrees to 5.7 degrees (P = 0.21). Patients with less than 9 mm of preoperative anterior disc height had an increase in their ROM (2.2 degrees) compared with a loss of ROM (-2.2 degrees) in patients with more than 9 mm of preoperative disc height (P = 0.02). Patients with between 16 mm and 18 mm of postoperative anterior disc height have greater ROM (7.5 degrees) than those above or below this range (3.6 degrees and 3.6 degrees respectively, P < 0.05). There was no correlation or threshold effect between clinical outcomes and disc height. CONCLUSION: Patients with greater disc collapse benefit more in ROM from a total disc replacement. The optimal range to maximize ROM for postoperative anterior disc height is 16 mm to 18 mm. This optimal range did not translate into better clinical outcome at 2 years follow-up PMID: 18317194
ISSN: 1528-1159

Spine. 2007;32(25):2905-2909. DOI: 10.1097/BRS.0b013e31815b84ae
Comparative charge analysis of one- and two-level lumbar total disc arthroplasty versus circumferential lumbar fusion
Levin, David A; Bendo, John A; Quirno, Martin; Errico, Thomas; Goldstein, Jeffrey; Spivak, Jeffrey
STUDY DESIGN: This is a retrospective, independent study comparing 2 groups of patients treated surgically for discogenic low back pain associated with degenerative disc disease (DDD) in the lumbosacral spine. OBJECTIVE: To compare the surgical and hospitalization charges associated with 1- and 2-level lumbar total disc replacement and circumferential lumbar fusion. SUMMARY OF BACKGROUND DATA: Reported series of lumbar total disc replacement have been favorable. However, economic aspects of lumbar total disc replacement (TDR) have not been published or studied. This information is important considering the recent widespread utilization of new technologies. Recent studies have demonstrated comparable short-term clinical results between TDR and lumbar fusion recipients. Relative charges may be another important indicator of the most appropriate procedure. We report a hospital charge-analysis comparing ProDisc lumbar disc replacement with circumferential fusion for discogenic low back pain. METHODS: In a cohort of 53 prospectively selected patients with severe, disabling back pain and lumbar disc degeneration, 36 received Synthes ProDisc TDR and 17 underwent circumferential fusion for 1- and 2-level degenerative disc disease between L3 and S1. Randomization was performed using a 2-to-1 ratio of ProDisc recipients to control spinal fusion recipients. Charge comparisons, including operating room charges, inpatient hospital charges, and implant charges, were made from hospital records using inflation-corrected 2006 U.S. dollars. Operating room times, estimated blood loss, and length of stay were obtained from hospital records as well. Surgeon and anesthesiologist fees were, for the purposes of comparison, based on Medicare reimbursement rates. Statistical analysis was performed using a 2-tailed Student t test. RESULTS: For patients with 1-level disease, significant differences were noted between the TDR and fusion control group. The mean total charge for the TDR group was $35,592 versus $46,280 for the fusion group (P = 0.0018). Operating room charges were $12,000 and $18,950, respectively, for the TDR and fusion groups (P < 0.05). Implant charges averaged $13,990 for the fusion group, which is slightly higher than the $13,800 for the ProDisc (P = 0.9). Estimated blood loss averaged 794 mL in the fusion group versus 412 mL in the TDR group (P = 0.0058). Mean OR minutes averaged 344 minutes for the fusion group and 185 minutes for the TDR (P < 0.05). Mean length of stay was 4.78 days for fusion versus 4.32 days for TDR (P = 0.394). For patients with 2-
level disease, charges were similar between the TDR and fusion groups. The mean total charge for the 2-level TDR group was $55,524 versus $56,823 for the fusion group (P = 0.55). Operating room charges were $15,340 and $20,560, respectively, for the TDR and fusion groups (P = 0.0003). Surgeon fees and anesthesiologist charges based on Medicare reimbursement rates were $5857 and $525 for the fusion group, respectively, versus $2826 and $331 for the TDR group (P < 0.05 for each). Implant charges were significantly lower for the fusion group (mean, $18,460) than those for 2-level Synthes ProDisc ($27,600) (P < 0.05). Operative time averaged 387 minutes for fusion versus 242 minutes for TDR (P < 0.0001). EBL and length of stay were similar. CONCLUSION: Patients undergoing 1- and 2-level ProDisc total disc replacement spent significantly less time in the OR and had less EBL than controls. Charges were significantly lower for TDR compared with circumferential fusions in the 1-level patient group, while charges were similar in the 2-level group.

PMID: 18246016
ISSN: 1528-1159
**What is your diagnosis? Erythema Ab Igne** [Case Report]

Warycha, Melanie; Goldstein, Jeffrey; Hale, James J

PMID: 17243424
ISSN: 0011-4162


**Transcatheter repair of recurrent postinfarct ventricular septal defects**

Shah, Nirav R; Goldstein, Jeffrey A; Balzer, David T; Lasala, John M; Moazami, Nader

Surgical repair of recurrent postmyocardial infarction septal defect is associated with a high mortality rate. We present 2 patients whose recurrent defects were closed percutaneously using an Amplatzer device

PMID: 16242481
ISSN: 1552-6259

**Foot & ankle international. 2002:23(12):1119-1123.** DOI:

**Toe flexor forces in dancers and non-dancers**

Nihal, Aneel; Goldstein, Jeffrey; Haas, Judith; Hiebert, Rudi; Kummer, Frederick J; Liederbach, Marijeanne; Trepan, Elly

Toe flexor force (hallux and second toe) was determined in the right and left feet of 24 dancers and 29 non-dancers (sitting and standing positions) using a commercially-available pressure sensor connected to a voltmeter. For the hallux and second toe combined (all trials combined), average toe flexor force was slightly greater for dancers than non-dancers (dancers, 7 +/- 4 N; non-dancers, 6 +/- 4 N; P<0.049). For dancers and non-dancers combined (all trials), the average toe flexor force of the hallux was more than twice that of the second toe (hallux, 9 +/- 4 N; 2nd toe, 4 +/- 1 N; P<0.0001); average toe flexor force was slightly greater in standing than sitting positions (standing, 7 +/- 4 N; sitting, 6 +/- 3 N; P<0.0001); and the average toe flexor force was slightly greater for the right than left foot (right, 7 +/- 4 N; left, 6 +/- 4 N; P<0.012). The average toe flexor force was greatest for the first repetition and slightly decreased for the second and third repetitions (first repetition, 7 +/- 4 N; second and third repetitions each, 6 +/- 4 N; P<0.0013). Toe flexor force measurement may potentially be applicable to clinical practice as a guide to rehabilitation after injury or as a screening parameter for readiness to advance dance or other athletic training, performance, or competition

PMID: 12503803
ISSN: 1071-1007

**Bulletin (Hospital for Joint Diseases). 2001:60(3-4):173-178.** DOI:

**The ACL-deficient knee: natural history and treatment options**

Goldstein J; Bosco JA 3rd

Injury to the anterior cruciate ligament removes the major stabilizing structure to anterior tibial translation. The initial trauma may lead to meniscal and cartilage damage, predisposing the knee to early degenerative changes. Moreover, a knee with an isolated ACL rupture may have recurrent episodes of instability that can lead to a similar degenerative course. At this time, one cannot accurately predict which patients will tolerate ACL deficiency, and which patients will not. Current long-term studies support a progressive worsening condition in the ACL and meniscal deficient knees. Physical therapy together with lifestyle modifications may be necessary. Those unwilling to make these types of changes or those with associated injuries may benefit from ACL reconstruction

PMID: 12102406
Lumbar sagittal alignment after fusion with a threaded interbody cage
Goldstein JA; Macenski MJ; Griffith SL; McAfee PC

STUDY DESIGN: Records of 111 patients randomly selected from a population who received an interbody fusion cage during a clinical Investigation Device Exemption trial (BAK/L) yielded 126 operative levels and were retrospectively assessed. OBJECTIVES: This study examined lumbar spine sagittal alignment and clinical outcomes before and 2 years after fusion surgery. SUMMARY OF BACKGROUND DATA: Lumbar lordosis is important in spinal sagittal alignment and balance, especially the L4-S1 area. Perceived consensus is that anatomically correct lumbar lordosis is desired and that a loss of lumbar lordosis may lead to spine pathology. There is little information on lumbar lordosis after interbody fusion. METHODS: A random sample of 111 patients who received a cylindrical cage implant (total pool of 947 patients) yielded 126 operative lumbar segments. There were 52 posterior approaches and 59 anterior approaches, and all cages were placed in the L4-L5 or L5-S1 levels. Preoperative and 2-year follow-up lateral radiographs were measured for segmental lordosis. Cage position was measured relative to the posterior longitudinal ligament. Segmental lordotic change was correlated to clinical outcome at the 2-year follow-up. RESULTS: Preoperative lordosis was different as a function of surgical approach. There was a significant 2-year decrease in lordosis with the posterior approach group; however, all intervertebral angles were within typical ranges. Clinical outcomes were significantly improved 2 years postsurgery. There was no correlation between changes in lordosis and clinical outcomes. CONCLUSIONS: Interbody lumbar fusion with a threaded cylindrical cage does not appear to have any clinically relevant effects on segmental lordosis, which is maintained within anatomically normal levels. Clinical outcome measures show significant postsurgery improvement, and changes in lordotic angles are not predictive of clinical outcome

PMID: 11413426
ISSN: 0362-2436

Salter-Harris III stress fracture of the proximal first metatarsal: A case report
Kadel, NJ; Goldstein, J; Newberg, AH; Trepman, E

An intraarticular, dorsal, proximal epiphysal stress fracture (Salter-Harris III) of the first metatarsal was identified in a 14-year-old boy. Successful fracture healing was achieved with a rocker sole shoe modification and activity limitation

ISI:000177410400014
ISSN: 1071-1007

Molecular pathogenesis in sporadic head and neck paraganglioma
Bikhazi, P H; Messina, L; Mhatre, A N; Goldstein, J A; Lalwani, A K

HYPOTHESIS: Similar to familial tumors, sporadic head and neck paragangliomas are associated with chromosomal deletions at either 11q13 or 11q22-23. BACKGROUND: Familial paragangliomas are inherited in an autosomal dominant pattern with genomic imprinting of the maternal allele. Genetic studies of familial paragangliomas have localized the causative genetic defect to two separate loci: 11q13.1 and 11q22-23. The molecular pathogenesis of sporadic head and neck paragangliomas has not been studied. METHODS: Blood and tumor samples from patients with sporadic head and neck paragangliomas were screened for deletions on chromosome 11 using DNA microsatellite markers and polymerase chain reaction. Polymerase chain reaction-amplified alleles from tumor specimens were
compared with those from the blood of eight patients. A greater than 50% reduction in band intensity (as determined by densitometric analysis) between blood and tumor sample was indicative of a chromosomal deletion. RESULTS: Three of the eight patients were found to have deletions at chromosome 11q: two at chromosome 11q22-23 and one at 11q13. CONCLUSIONS: Sporadic head and neck paragangliomas are associated with deletions at chromosome 11q13 and 11q22-23. It is thus likely that sporadic and familial paragangliomas share a similar molecular pathogenesis.

PMID: 10942138
ISSN: 0023-852X

**Rheumatic diseases clinics of North America. 2000:26(3):593-616.** DOI:

**Selected orthopedic problems in the elderly**
Goldstein J; Zuckerman JD

The changes that occur in the body as part of the normal aging process and the degenerative changes that often accompany them predispose the elderly to various orthopedic problems. Age, general health, and functional level are all important factors in determining the optimum management of these patients. Treatments are aimed at restoring patient independence and activity to preinjury levels, while at the same time minimizing the risks of treatment complications.

PMID: 10989514
ISSN: 0889-857x

**Hospital practice (office edition). 1984:19(4).** DOI:

**Fever, cough, anal ulcer in a heterosexual man** [Case Report]
de Caprariis, P J; Giron, J A; Goldstein, J A; Klein, N; Molho, L

PMID: 6425310
ISSN: 8750-2836

**Annals of internal medicine. 1984:101(5):721-721.** DOI:

**Mycobacterium avium-intracellulare infection and possibly venereal transmission** [Letter]
de Caprariis, P J; Giron, J A; Goldstein, J A; LaBombardi, V J; Guarneri, J J; Laufer, H

PMID: 6548345
ISSN: 0003-4819