



Anterior segmental fusion with Chuinard & Peterson bone graft and percutaneous facet screw fixation for the treatment of pyogenic spondylodiscitis secondary to microdiscectomy

Mikrodiskektomiye bağlı lomber piyojenik spondilodiskit tedavisinde Chuinard-Peterson tipi kemik greftiyle anterior füzyon ve perkütan faset vida fiksasyonu

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Objectives: Lumbar pyogenic spondylodiscitis is a serious complication after microdiscectomy. A new surgical technique is described for its treatment and preliminary results are presented.

Patients and methods: Four consecutive patients (3 men, 1 woman; mean age 60 years; range 47 to 75 years) with pyogenic spondylodiscitis secondary to microdiscectomy were treated with anterior fusion with the Chuinard & Peterson type bone graft and percutaneous facet screw fixation. All the patients had infection of the deep anterior column, which was associated with posterior soft tissue infection from a previous wound. The mean time interval between microdiscectomy and fusion was 2.4 months (range 6 weeks to 4 months). An autoiliac tricortical bone graft was used according to the Chuinard & Peterson technique for anterior fusion, followed by percutaneous facet screw fixation. The mean follow-up period was 11 months (range 5 to 17 months).

Results: The mean operation time and blood loss were 207 minutes (range 150 to 285 min) and 900 ml (range 500 to 2000 ml), respectively. The only complication was an avulsion fracture in the anterior ilium. C-reactive protein levels decreased by 50% after an average of two weeks (range 1 to 3 weeks). The mean hospital stay was 41 days (range 31 to 46 days). The hematological profile of the patients remained normal until the last follow-up. Fusion surgery was satisfactory and all the patients showed significant improvement in complaints of back and leg pain. Bony union was achieved in a mean of 8.5 months (range 5 to 18 months). No graft failure, recurrence of infection, or significant kyphosis were noted.

Conclusion: Anterior segmental fusion using the Chuinard & Peterson bone graft followed by percutaneous facet screw fixation was found effective for pyogenic spondylitis with posterior soft tissue infection.

Key words: Bacterial infections; bone screws; bone transplantation; intervertebral disk displacement/surgery; lumbar vertebrae/surgery; osteomyelitis/etiology/surgery; postoperative complications.

Amaç: Lomber piyojenik spondilodiskit, mikrodiskektomiden sonra gelişebilecek ciddi bir komplikasyondur. Bu yazıda, bu enfeksiyonun tedavisi için yeni bir cerrahi teknik, erken sonuçlarıyla birlikte sunuldu.

Hastalar ve yöntemler: Mikrodiskektomiden sonra gelişen lomber piyojenik spondilodiskit nedeniyle ardışık dört hastaya (3 erkek, 1 kadın; ort. yaş 60; dağılım 47-75) Chuinard-Peterson tipi kemik greftiyle anterior füzyon ve perkütan faset vida fiksasyonu uygulandı. Tüm hastalarda, önceki bir yaradan gelişen posterior yumuşak doku enfeksiyonuna bağlı derin anterior kolon enfeksiyonu vardı. Mikrodiskektomi ile füzyon arasındaki ortalama süre 2.4 ay (dağılım 6 hafta-4 ay) idi. Anterior füzyonda, Chuinard-Peterson tekniğine uygun olarak hazırlanan otoiliyak trikortikal kemik grefti kullanıldı; ardından perkütan faset vida fiksasyonu yapıldı. Ortalama izlem süresi 11 ay (dağılım 5-17 ay) idi.

Bulgular: Ortalama ameliyat süresi ve kan kaybı sırasıyla 207 dakika (dağılım 150-285) ve 900 ml (dağılım 500-2000 ml) bulundu. Tedaviyle ilgili görülen tek komplikasyon, bir olguda anterior iliumda gelişen avulsiyon kırığı idi. C-reaktif protein düzeyi ameliyattan sonra ortalama iki hafta içinde (dağılım 1-3 hafta) %50 düşüş gösterdi. Hastanede kalma süresi ortalama 41 gün (dağılım 31-46 gün) bulundu. Hastaların hematolojik tablosu son izleme kadar normal seyretti. Füzyon cerrahisi tatmin edici sonuç verdi; hastaların sırt ve bacak ağrısı yakınmalarında önemli düzelme görüldü. Kemik kaynaması ortalama 8.5 ayda (dağılım 5-18 ay) gerçekleşti. Greft kaybı, enfeksiyon nüksü ve önemli derecede kifoz gelişimiyle karşılaşılmadı.

Sonuç: Chuinard-Peterson tipi kemik greftiyle anterior segmental füzyon ve perkütan faset vida fiksasyonunun, posterior yumuşak doku enfeksiyonunun eşlik ettiği piyojenik spondilit tedavisinde etkili olduğu görüldü.

Anahtar sözcükler: Bakteriyel enfeksiyon; kemik vidası; kemik transplantasyonu; intervertebral disk deplasmanı/cerrahi; lomber vertebra/cerrahi; osteomyelit/etiyoloji/cerrahi; ameliyat sonrası komplikasyon.

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Pyogenic spondylodiscitis is one of the most severe complications following lumbar posterior surgery, occurring in about 1% of all cases.^[1] Conservative treatment, including bed rest and prolonged antibiotics is usually recommended,^[1,2] but surgery is often needed. The recommended surgical treatment is anterior curettage and fusion, with an autoiliac bone graft, followed by prolonged immobilization.^[3] Many surgeons augment rigid posterior instrumentation to the anterior bone graft to provide initial stability and prevent delayed deformity.^[4-12] However, these techniques may cause considerable morbidity, especially in old age patients, and the safety of instrumentation within the infected field remains controversial.^[13-15]

In this paper, the authors present a new surgical method to modify the grafting technique, which is used in conjunction with a minimally invasive percutaneous procedure that assures a relatively rigid fixation.

PATIENTS AND METHODS

Four consecutive patients (3 men, 1 woman; mean age 60 years; range 47 to 75 years) with pyogenic spondylodiscitis as a complication of microdiscectomy were treated with anterior fusion with the Chuinard & Peterson type bone graft and percutaneous facet screw fixation between 2003 and 2004. All the patients

developed spondylodiscitis after a microdiscectomy, which presented with persistent or recurred back and leg pain. Diagnosis was made by magnetic resonance imaging with enhancement, and the causative microorganism was identified in specimens obtained during debridement surgery. All the patients had infection of the deep anterior column (spondylodiscitis), which was associated with posterior soft tissue infection from a previous wound (Fig. 1). Debridement was attempted as either an endoscopic (2 cases) or open procedure (2 cases), but all failed. The indication for fusion was persistent infection resistant to debridement and antibiotic treatment. The mean time interval between microdiscectomy and fusion was 2.4 months (range 6 weeks to 4 months). After surgical treatment, a periodic follow-up was carried out and the patients were examined by plain radiographs and hematologic studies including C-reactive protein. Remission of infection was defined as improvement in both the clinical condition and hematologic profile. Fusion was confirmed by the presence of bone bridge formation anterior to the bone graft on lateral plain radiographs. Segmental lordosis was assessed by measuring the angles between the two lines drawn from the upper end plate of the upper vertebra and the lower end plate of the lower vertebra. The mean follow-up period was 11 months (range 5 to 17 months).



Fig. 1. T₁- and T₂-weighted magnetic resonance sagittal images of a 75-year-old male patient. He developed spondylodiscitis associated with a posterior soft tissue infection from the previous wound site 6 weeks after microdiscectomy and ligamentoplasty at L₄₋₅.

Surgical technique

Anterior curettage was performed by a midline retroperitoneal approach in the supine position. Infected tissues, including the disc, cartilaginous end plate and necrotic bone were removed until bleeding bone was exposed. A tricortical bone graft about 3x3 cm in size was harvested from the anterior iliac crest. After removing soft tissues from the harvested bone, a 1.8 mm drill bit was used to make multiple holes penetrating the cortical bone (Fig. 2). The bone graft was inserted into the defect after maximum distraction, the convex side of the graft matching the concave surface of the lower vertebral body (Fig. 3). The wound was closed, and the patient was changed to the prone position. Percutaneous facet screw fixation was performed bilaterally with two 5.0 mm AO titanium screws. All the percutaneous procedures were carried out with a C-arm except in one case, which was performed under CT guidance.

Postoperatively, all the patients were allowed to ambulate with a lumbar brace the day after the operation and were not discharged until intravenous antibiotics were no longer needed. Oral antibiotics were administered after discharge until the hematologic profile became normal.

RESULTS

Coagulase-negative staphylococcus was identified in all the cases, with methicillin-resistance in two cases. Involvement was at L₄₋₅ in three cases and L₃₋₅ in one case. The mean operation time and blood loss were 207 minutes (range 150 to 285 minutes) and 900 ml (range 500 to 2000 ml), respectively. Massive bleeding (2000 ml) occurred in one patient due to injury to the iliac vein during dissection of adhesions in the anterior longitudinal ligament. The only postoperative complication

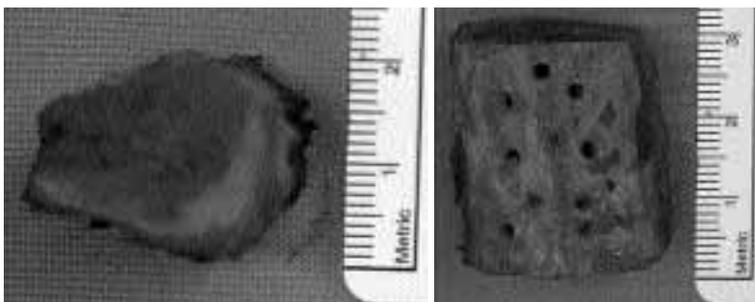


Fig. 2. Appearance of the Chuinard & Peterson type bone graft. Multiple drill holes were made to facilitate fusion.

was an avulsion fracture in the anterior ilium, which was treated conservatively.

Postoperatively, C-reactive protein levels decreased by 50% from the baseline after an average of two weeks (range 1 to 3 weeks). The mean hospital stay was 41 days (range 31 to 46 days). Antibiotic usage after surgery lasted about 2.5 months. The hematological profile of the patients remained normal until the last follow up. Fusion surgery was satisfactory and all the patients showed significant improvement in complaints of back and leg pain.

Bony union was achieved in a mean of 8.5 months (range 5 to 18 months). No graft failure was noted, but graft subsidence was detected in all the cases at the final follow-up, which resulted in a decrease in segmental lordosis from 13.2 degrees (range 9 to 18 degrees) to 6.9 degrees (range 2 to 12 degrees) (Fig. 4).

DISCUSSION

The Chuinard & Peterson bone graft technique was originally developed for ankle fusion.^[16] This technique has some theoretical advantages compared to conventional bone graft methods, in that it has a broad contact surface providing resistance to axial forces, and due to the shape of the iliac crest, the graft has an inherent initial stability. Because vertebral destruction in lumbar spondylodiscitis is usually localized to the end plate or to less than 50% of the adjacent vertebra, the radiological finding of the infected segment is like 'ballooning of disc space',^[17,18] where the convex surface of the Chuinard & Peterson graft usually fits the concave surface of the vertebral body. This feature enabled

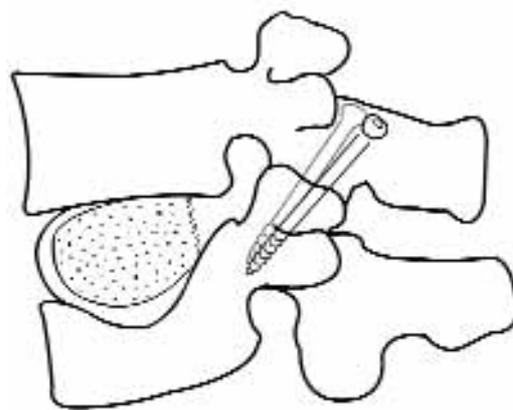


Fig. 3. Schematic drawing of the Chuinard & Peterson bone graft and facet screw fixation.

even a delayed bony union (18 months) in one patient without graft failure or expulsion.

Facet screw fixation provides segmental stability, especially against torsion and extension forces and has been found comparable to pedicle screw fixation in both experimental and clinical studies.^[19-21] The advantage of a facet screw in terms of infection control is that it can be inserted and removed percutaneously without soft tissue dissection. Additionally, the placement of the facet screw is confined to the posterior column, minimizing the dissemination of contamination between the anterior and posterior columns. In case of significant facet loss associated with a previous surgery, the screw can be inserted by a translaminar route to the pedicle.

There are two problems in performing pedicle screw instrumentation to augment an anterior graft: persistent or recurred infection around the implant, and surgery-related morbidity. Instrumentation in an infected environment may result in fixation fail-



Fig. 4. Lateral plain radiograph of a 75-year-old male patient 11 months after surgery. Solid bony union was achieved with 5 degrees of segmental lordosis.

ure due to loosening at the metal-bone interspace, and eventually, recurrent infections due to bacteria-associated biofilms.^[13-15] In such cases, one example of which is a patient who presented with anterior column infection associated with the posterior component through a previous wound, the use of pedicle screw instrumentation with a wide exposure is quite controversial.

A wide posterior exposure for instrumentation requires more anesthesia and results in increased bleeding. Despite favorable results in eradicating infection and preventing kyphosis, perioperative morbidity and mortality rates in previous studies were as much as 50%.^[4-6,9,10,12] Surgery-related morbidity in our patients was comparable with that reported in other studies. There were no complications related to posterior instrumentation, as it was possible to use a minimally invasive approach. There was no immobilization-related morbidity as the patients were encouraged to ambulate the day after the operation.

The time to graft fusion averaged 8.5 months in this study. Bony union after anterior fusion and posterior instrumentation has been reported as 3.9 to 8.6 months.^[10,11] Moreover, posterior instrumentation has been shown to shorten the time to bony union by 50% compared to anterior surgery alone.^[10] However, differences may exist depending on how union is radiologically defined; contact through the cortical bone may require more time for bony union than that needed for the cancellous bone. We noted that, even without evidence of solid bony union such as bone bridge formation, surgery provided sufficient stability to resist infection without graft failure.

The change in segmental lordosis was comparable to those reported in other studies. Emery et al.^[3] reported an increase in kyphosis by 3° after an anterior bone graft alone. Others reported 11 to 12 degrees of kyphosis correction after anterior fusion with posterior instrumentation.^[7,10] In this study, some loss of lordosis (mean 6.3°) occurred in all the cases after bony fusion, but it maintained throughout the short-term follow-up.

In conclusion, anterior segmental fusion using the Chuiard & Peterson bone graft followed by percutaneous facet screw fixation was found effective for pyogenic spondylitis with posterior soft tissue infection. However, further studies with large patient groups and long-term follow-up

results are required to monitor recurrences of infection or delayed kyphosis.

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