Lumbar radicular pain, a common entity in clinical practice, is frequently caused by disk herniation or degenerative changes in vertebrae (1). Intervertebral disk herniations are the most common cause of lumbosacral radiculopathy, more than half of the patients with lumbar radicular pain report a decline in their activities of daily living and ability to work (2). But overall, the majority of patients with lumbosacral radiculopathy recover with conservative care after 1 year (3). To reduce this natural recovery time, numerous authors have proposed local delivery of corticosteroids and anesthetics to the affected nerve root (4, 5). Since the early reports, success rates of epidural steroid injection (ESI) ranging from 20% to 100% (average 67%) have been documented (6). To help minimize complications and provide patients with a safe and effective procedure, fluoroscopic or computed tomography (CT) guided epidural injection has been used (7). However, there have been few studies on CT guided ESI. We tried to evaluate safety

Purpose: CT guided epidural steroid injection (ESI) is not commonly used for the management of lumbar pain in Korea. Therefore, we evaluated a short term improvement as defined by the scale of pain after CT guided ESI.

Materials and Methods: We prospectively followed 29 consecutive patients (average age, 62 years; range, 38–78 years; 10 men, 19 women) with lumbar radiculopathy for a minimal follow-up period of 1 month. The intensity of radicular pain was scored by the patient on the visual analog scan (VAS), from 0 (no pain) to 10 (maximal intensity). Scores before and after the procedure were compared by using the Wilcoxon signed-rank test for paired values. Pain relief was classified as “0” when the pain was completely resolved or had diminished, “1” for not changing, “2” for an increase in pain.

Results: The mean VAS scores were 8 (range, 2–10) before and 5 (range, 1–10) 1 month after the procedure, with significant pain relief (p < .001). Pain relief was divided as 0 in 21 patients (72%), 1 in 8 patients (28%) without anyone of grade 2. There was no procedure-related complication except one patient with temporary left side weakness and sensory change which lasted 1–2 hours and subsided thereafter probably due to temporary route compression caused by previous postoperative adhesion or inadvertent intrathecal injection.

Conclusion: Good pain relief can be expected after CT guided ESI. CT guided ESI may have some difficulties in postoperative patient with metal devices or adhesion.

Key Words: Spine; Pain intervention; Epidural steroid injection
MATERIALS AND METHODS

From March 2009 to October 2009, we prospectively followed 29 consecutive patients (average age, 62 years; range, 38–78 years; 10 men, 19 women) with lumbar radiculopathy for a minimal follow-up period of 1 month. Patients were recruited from the pain department of our institution, and all parameters were defined in this prospective clinical case series before the study. The patients were referred from clinical departments due to clinical signs of lower back pain and/or sciatica. Twelve patients had history of spinal surgery related to the diseased level.

Procedure

In the operating room, equipped with CT scan (General Electric HighSpeed CT/I Pro, Milwaukee, WIS, USA), the patient was placed on his or her back on a CT bed. A linear midline marker was placed on her or his back longitudinally and the level of the lumbar spine involved was pilot scanned. Four slice images were obtained which covered almost the entire disc space and neural foramen for determination of the table position and needle pathway. The suggested ideal needle pathway was a straight line from the skin to the point of posterior epidural fat triangle. The skin entry point and pathway was drawn and measured on an axial image with reference to the midline marker on the skin. Usual measurements were 5.5 cm in pathway and 1.8 cm from midline to skin entry point. After a skin wheal was made, the skin was prepped and 1% lidocaine was injected for local anesthesia. A 22G Spinal Needle (Samsung Biomed, Seoul, Korea) with 9 cm length was inserted on the marked point of the skin and advanced. As the needle was advanced through the pathway drawn, and CT image was taken. As the needle tip reached the target point planned until saline give a sense of no resistance, about 0.2 cc contrast media were injected to confirm the epidural space. When we confirmed that the contrast scattered around the epidural space, 40 (n = 24) or 80 mg (n = 5) triamcinolone were injected slowly. While removing the needle, small amount of 0.5% bupivacaine was injected. The patients were followed up for efficacy and complications at 1 month after the procedure in the outpatient clinic.

Data analysis and statistical analysis

The intensity of radicular pain was scored by the patient on the visual analog scan (VAS), from 0 (no pain) to 10 (maximal intensity). Pain relief was classified as “0” when the pain was completely resolved or had diminished, “1” for not changing, “2” for an increase in pain. 29 patients were evaluated for the effectiveness of the treatment by VAS scores before and after the procedure and recorded complications by an interventionist for 1 month.

Scores before and after the procedure were compared by using the Wilcoxon signed-rank test for paired values.

RESULTS

Radiculopathy level was L4-5 in 20 patients, L3-4 in 7 patients, L2-3 in 2 patients. The cause was disc bulging in all cases with variable degree of degenerative stenosis as a result of disc bulging, hypertrophic facet joints, thickening of ligamentum flavum in most cases.

The mean VAS scores were 8 (range, 2–10) before and 5 (range, 1–10) 1 month after the procedure, with significant pain relief (p < .001). Pain relief was divided as 0 in 21 patients (72%), 1 in 8 patients (28%) without anyone of grade 2. One patient whose VAS score was 10 before the procedure, temporarily expressed left side weakness and sensory change in both legs right after the procedure. Such symptoms lasted 1–2 hours and gradually subsided thereafter. VAS score 1 month after the procedure was still 10.

CT guided Epidural Steroid Injection

Fig. 1. A 63-year-old female with back pain due to lumbar spinal stenosis. A needle was introduced obliquely into the triangular shaped epidural fat space which was confirmed after injection of a small amount of contrast agent.
This patient underwent posterior lumbar interbody fusion and decompression in L4-L5 5 months prior to the ESI. The cause of temporary aggravation was regarded as having root compression due to postoperative adhesion or inadvertent intrathecal injection of a small amount of steroid. No other complications occurred after the procedure. Two patients proceeded to another ESI, one using the same technique after 2 months and the other using the fluoroscopic guided technique after 3 weeks. One of two underwent surgical L4-5 fusion 10 weeks after 2nd ESI due to segmental instability and stenosis.

DISCUSSION

Etiology of lumbar radicular pain is variable. However chronic lumbar radicular pain is mostly due to herniated disc or lumbar stenosis. From the pathophysiological standpoint, soluble mediators of inflammation play a significant role in intractable pain or perpetuating it (8). Anti-inflammatory agents have a role in controlling the signs and symptoms of lumbar radicular pain. These agents can be delivered to the site of inflammation by systemic or local treatment. ESI, as a kind of local therapy in this regard, has some advantages over systemic therapy, such as getting higher concentrations of the drug to the diseased area and notably having a lower rate of systemic adverse effects like neuro-endocrine axis suppression and hyperglycemia (9). Corticosteroids are known to inhibit prostaglandin synthesis, impair both cell-mediated and humoral immune responses, stabilize cellular membranes (10). Furthermore, the high efficacy of ESI may be explained by four mechanisms of action; 1) the precise delivery of the steroid and xylocaine solution; 2) the nerve membrane-stabilizing properties of both the steroid and xylocaine; 3) “washout” effect of the solution, which decreases the regional levels of inflammation mediators such as interleukin-1, phospholipase A2; and 4) the potent anti-inflammatory properties of the steroid (11, 12). However ideal dose and type of steroid have not been determined yet. Owlia et al. (9) reported that the incidence of post-injection flares, flushing, and hyperglycemia was significantly lower among patients who received a low dose (40 mg) compared to a high dose (80 mg) administration. In our study, we used a low dose 24 patients and a high dose (80 mg) triamcinolone in 5 patients out of 29 patients.

The pain-relief efficacy results for ESI are inconsistent in the literature. Lutz et al. (13) in 69 patients with diskal herniation, and Botwin et al. (14) in a degenerative stenosis population (34 patients) both reported a pain decrease of more than 70% according to VAS scores at the early follow-up. On the contrary, Ng et al. (15) and Karppinen et al. (16) obtained only 35% to 45% leg pain improvement at the 2 week follow-up. These different results could be explained by differences in technical flaws and study design (1). The procedure can be performed under fluoroscopic or CT scan guidance, which could ensure accurate positioning of the needle tip. In our study, we could identify the major vessels and nerve roots on a CT axial view and guide the needle exactly where it should be, avoiding injury to the neural and vascular structures under CT scan guidance. This study demonstrated decreased VAS from 8 to 5 (p < .005), and better outcome (72%) after procedure. None of the patients complained aggravated pain or any local or general complications after ESI.

The effects of ESI were documented in 2 weeks, 1 month, or later and slightly better results (9) after one month may be due to late response of long-acting methyprednisolone or individual variations in receptor response to agents. This means maximal beneficial effect of ESI is experienced around one month after injection. In our results ESI was repeatedly performed in 2 patients and their responses to ESI declined after 1 month.

Factors associated with the decreased success experienced by the steroid-anesthetic study group include preexisting spondylolisthesis in addition to disc herniation and duration of symptoms exceeding 1 year. When disc herniation occurs at the level of preexisting spondylolisthesis, the natural history of recovery may change. The mechanical alteration of the disc-bone-nerve root interface in spondylolisthesis cannot be expected to change with the administration of epidural steroids (17). Lutz et al. (13) reported that patients with lateral recess stenosis respond less favorably that patients with disc herniation alone, and they are more likely to require surgical intervention to decompress the area of stenosis. One patient having repeated ESI in our study had also lumbar stenosis at L4-5 and segmental instability, and her pain was not decreased even after 2nd ESI and finally relieved after surgical fixation.

The limitations of this study is the small patient population (n = 29) and it was not compared with a control population and consequently a placebo effect could not be assessed. Most patients with radicular lumbar pain have significant spontaneous improvement over time and the improved results in patients with short duration pain may in fact partially represent natural improvement, that may occur with time in this.
group. It would have been interesting to know which population could have benefited from a second or third infiltration in a short and long term follow ups. Further studies are required to assess patient groups according to the cause of pain, its duration before the procedure and the overall effect of the first infiltration.

In conclusion, in patients with lumbar radicular pain, ESI guided with CT scan with 40 mg dose triamcinolone may be effective and safe without any adverse effect. However more larger extended controlled study for the efficacy of serial steroid injection for lumbar radicular pain is needed.

References
목적: CT 유도 경막외 스테로이드 주입술 (ESI)은 요추부 동통치료로 최근 많이 이용되는 치료법이다. VAS (visual analogue scale)을 이용하여 ESI의 단기간 추적관찰 결과를 보고하고자 한다.

대상 및 방법: 요추부 동통을 호소하는 29명의 환자에서 (평균 나이, 62세, 38-78세, 남자 10명, 여자 19명) ESI를 시행하였고 1개월 추적관찰을 하였다. 동통의 정도는 0 (무통)부터 10 (가장 심한 동통)으로 점수화 되는 VAS를 이용하였고 시술 전과 후를 Wilcoxon signed-rank test를 이용하여 비교하였다. 동통의 경감은 0(호전), 1 (변화없음), 2 (악화)로 표시하였다.

결과: 시술 전 평균 VAS 는 8점 (범위: 2-10)이었고 시술 후는 5점 (범위: 1-10)이었으며 이는 통계적으로 의의가 있었다. 동통의 경감은 21명 (72%)이 0, 8명 (28%)이 1이었고 2를 나타낸 환자는 없었다. 시술과 관련된 합병증은 없었고 1명의 환자에서는 수술 후 유착 혹은 수막강내 주입으로 인한 신경근 압박으로 인한 일시적 좌측 운동성 약화와 감각마비가 있었다.

결론: CT 유도하 ESI 시술은 동통경감에 좋은 결과를 보였고 수술로 인한 유착이나 금속장치가 있는 환자에서는 어려움이 있을 수 있었다.

Key Words : Spine; Pain intervention; Epidural steroid injection