Observational Study

Patients with Refractory Back Pain Treated in the Emergency Department: Is Immediate Interlaminar Epidural Steroid Injection Superior to Hospital Admission and Standard Medical Pain Management?

Todd Miller, MD[1], Judah Burns, PhD[1], Jeffrey Gilligan, BS[1], Francis Baffour, MD[2], and Allan Brook, MD[1]

From: [1]Albert Einstein College of Medicine, Bronx, NY; [2]Mayo Clinic, Department of Radiology Rochester, MN

Address Correspondence:
Todd Miller, MD
Department of Radiology
Albert Einstein College of Medicine
111 E. 210th Street
Montefiore Medical Center
Bronx, NY 10466
E-mail: toddmiller@mac.com

Disclaimer: There was no external funding in the preparation of this manuscript. Conflict of interest: Each author certifies that he or she, or a member of his or her immediate family, has no commercial association (i.e., consultancies, stock ownership, equity interest, patent/licensing arrangements, etc.) that might pose a conflict of interest in connection with the submitted manuscript.

Manuscript received: 08-19-2014:
Revised manuscript received 10-14-2014
Accepted for publication: 11-24-2014

Free full manuscript: www.painphysicianjournal.com

Background: Hospital admissions for back pain are prolonged, costly, and common. Epidural steroid injections are frequently performed in an outpatient setting with an excellent safety and efficacy profile.

Objectives: The purpose was to review data from patients with severe pain that did not respond to aggressive medical treatment in the emergency department (ED) and determine the effectiveness of an interlaminar epidural steroid injection (ESI) in this patient population.

Study Design: Retrospective matched cohort design.

Setting: Single urban emergency department at a tertiary referral center.

Methods: A retrospective cohort comparison pairing 2 groups that both failed aggressive pain control in the ED was performed. The epidural injection group (1ESI) received an interlaminar ESI while in the ED. The standard therapy group (2ST) was admitted for medical pain management. Groups were matched for pain intensity, age, and symptom duration.

Results: Thirty-five patients in 1ESI (NRS 8.8, 5 – 10, 0.35), and 28 patients in 2ST (NRS 8.9, 4 – 10, 1.7). Pain score after ESI 0.33 (0 – 2, 0.6); all were discharged. Pain score on day 1 of hospital admission for 2ST was 8.7 (7 – 10, 1.5). Total ED time was 8 hours for 1ESI and 13 hours for 2ST ($P < 0.002$). 1ESI patients received less narcotics while in the ED ($P < 0.002$) and were discharged home with less narcotics than 2ST (< 0.002). Average inpatient length of stay (LOS) for 2ST was 5 (1.5 – 15, 3.3) days. Cost of care was over 6 times greater for those patients admitted for pain management ($P < 0.001$).

Limitations: Retrospective design, non-randomized sample, and a small patient population.

Conclusion: An ED patient cohort with severe refractory pain was treated with an interlaminar ESI after failing maximal medical pain management while in the ED. Complete pain relief was achieved safely and rapidly. The need for inpatient admission was eliminated after injection. Costs were lower in the group that received an epidural injection. Narcotic requirements upon discharge were decreased as well.

Key words: Low back pain, epidural steroid injection, emergency department, hospital admission

Pain Physician 2015; 18:E171-E176

Low back pain is recognized as a significant reason for patients' presentation to physicians in the ambulatory setting (1). Costs incurred from evaluation and treatment as well as reduction in work capacity are also significant (2). Severe low back pain is a common cause for emergency department (ED) visits (3). Costs associated with diagnosis and treatment are high in the ED setting (3). Most patients receive narcotics in the ED and are discharged with opioid pain medication, which incurs direct costs as well as potential unwanted effects from narcotics (3). Failure of pain control despite aggressive management in the ED leads to inpatient admission and an escalation of pain treatments (3). Nonsteroidal anti-inflammatory drugs (NSAIDs), intravenous narcotic agents, and muscle relaxants are the treatments of choice for those admitted to the hospital (4,5). These patients are also discharged with prescriptions for NSAIDS, muscle relaxants, and oral opioid analgesics with their attendant problems (4,6).

Epidural steroid injections (ESIs) have been recognized for several decades as a therapeutic option for patients with low back pain (7-9). They are almost exclusively performed on patients in the out-patient setting (10). Evidence-based guidelines for patient selection in the ambulatory setting are available (9). The technique is safe and provides rapid pain relief if performed with image guidance by experienced operators (11).

The efficacy of ESI for patients with low back pain in the ED setting has not been reported. In the outpatient setting, ESI has been shown to provide immediate short-term relief in appropriately selected patients (12,13). We predicted that an ESI would benefit patients with severe low back pain who failed aggressive management in the ED. The purpose of the study was to review historical data to see if ESI for patients in the ED setting was an effective means of providing pain relief, avoiding admissions, and reducing pain medication requirements upon discharge.

Methods

This retrospective cohort comparison was performed according to HIPAA regulations and was approved by the Institutional Review Board (IRB). A consecutive group of patients was retrospectively identified from a single ED database between 2009 and 2011. Patients presenting with severe low back pain were considered for inclusion. Patients reporting red flag symptoms were excluded during the collection process (14). If chart review identified patients with cancer, fracture, or infection during ED evaluation they were excluded from the cohort. Patients with causes other than spondylosis for pain symptoms were excluded from the study (retroperitoneal hematoma, fibromyalgia, renal stones). Included patients had pain caused by spondylosis refractory to treatment with NSAIDS, muscle relaxants, and intravenous narcotic medication. All were being considered for admission due to severe functional limitations from pain. This pool of patients was reviewed to identify the treatment plan. Depending on ED physician preference, some were referred for immediate ESI from the ED, while other patients were admitted to the hospital for pain control. The total pool of patients who received an ESI during the study period was identified. A matched group (age, gender, pain severity) admitted to the hospital for medical pain control was selected as a comparison.

For ESI group, ED physician preference was used to identify those patients suitable for immediate ESI. These patients were treated with an image-guided interlaminar ESI prior to hospital admission. This was considered cohort one (1ESI). For standard management group, an age, gender, and pain severity cohort was identified using hospital admission records from the same ED population during the study period. This group failed maximal attempts at medical pain management in the ED. Cohort 2 (2ST) was identified from amongst those treated with standard medical management and admitted for more aggressive medical pain control.

For both groups, data were gathered from an electronic medical record (EMR) that includes ED records, inpatient records, and outpatient records. ED records were reviewed for patient demographics and to determine if an ambulance was required to transport the patient to hospital. Total time in the ED, total medication usage in the ED, medication usage while admitted, discharge medications and length of stay (LOS) were recorded. Medication dosages were divided into total dose administered by class and type for simplified comparison. Cost estimates were obtained by totaling hospital billing for total technical charges for each patient encounter.

The numerical rating scale (NRS) was used to determine severity of pain (15). Notes from the ED record and subspecialty consultation were reviewed for details about the patient's pain. Duration of pain symptoms prior to presentation, axial or radicular character, and response to straight leg raise testing were recorded. Evidence of functional limitation (limited ambulation preventing discharge) or focal motor weakness (less

than 4/5 strength in affected extremity) was recorded as well.

Charts were reviewed for use of magnetic resonance imaging (MRI) at the time of presentation or within the past year. MRI examinations were reviewed and scored on a 3-point scale as follows: 1 (mild) – single level mild disease (bulge, annular fissure, absent canal stenosis, foraminal narrowing may be present), 2 (moderate) – same as 1 with multilevel disease, 3 (severe) – moderate or severe canal stenosis from large disc herniations, facet or ligament hypertrophy, or multilevel end plate degenerative changes and canal stenosis at multiple levels. Team members reviewed the available MRI scans and scored them separately. Group consensus was used to adjudicate disagreements.

Records were reviewed for treatment with ESI during index admission and evidence of immediate or delayed complications from follow-up office visits at 2 weeks. Subsequent hospital admissions and ED visits within a month follow-up period were recorded. Need for repeat ESI within a month after discharge was recorded. Evidence of lumbar surgery within a year of ED presentation was sought in the EMR, which included inpatient charts, ambulatory charts, radiology reports, and subsequent ED visits.

Statistical analysis was performed to compare the demographics of the 2 cohorts. Unpaired 2-tailed t-tests were used to determine significant differences in total dwell time in the ED, total medication utilization, consultation in the ED, pain duration prior to ED, and cost.

Results

For group 1ESI, 35 patients were referred for ESI prior to admission while in the ED. For group 2ST, 28 matched control patients admitted for pain management were identified. Patient and group characteristics are summarized in Table 1. The 1ESI group consisted of 16 women and 19 men, average age 47.7 (23 – 78, 13.6); 2ST group consisted of 15 women and 13 men, average age 48.6 (27 – 61, 10.2). Twenty-three (66%) of 1ESI and 16 (70%) 2ST arrived by ambulance. 1ESI patients were in the ED for 8 hours (3 – 18, 3.6) and 2ST patients were in the ED for 13 hours (5 – 22, 4.2) ($P < 0.002$). Average inpatient LOS for group 2ST was 5.05 days (1 – 14, 3.31). For each subject, the total cost of care for the index ED visits and treatment for group 1ESI was $4800 (SD 2000), and for ED visit, treatment, and inpatient charges was $33,000 (SD 14000) for 2ST ($P < 0.001$). As is shown in Table 2, 1ESI patients received 1/4 the total

Table 1. *Group characteristics*.

	1ESI Group	2ST Group	*P* value
N	35	28	
Age	47.7 (SD 13.6)	48 (SD 10)	
Gender	54% male	46% male	
EMS Arrival	23	16	
NRS Initial	8.8 (SD 1.5)	8.8 (SD 1.7)	
Functionally Limited	35	23	
Strength Limited	1	0	
Pain Duration (days)	39 (SD 71)	6 (SD 6)	
Consulted in ED	3	18	
SLR Pos	6	8	
MRI	23	17	
Type 1	15	13	
Type 2	7	3	
Type 3	2	2	
ED LOS (Hours)	8 (SD 3.6)	13 (SD 4.2)	P < 0.002
Inpatient LOS (Days)	0	5 (SD 3.3)	
Surgery within 1 year	2	0	
Total Cost of Care $	4800 (SD 2000)	33,000 (SD 14,000)	P < 0.0001

Table 2. *ED medication orders by group.*

Drug	Dosage	Number of Orders	
		Group 1ESI	Group 2ST
Ketorolac	30mg	3	13
	60mg	5	3
	100mg	1	0
Diazepam	5mg	9	19
Hydromorphone	0.5mg	0	2
	1mg	2	11
	2mg	7	12
	4mg	0	5
	5mg	0	1
Oxycodone / Acetaminophen	5/325mg	22	17
	10/325mg	1	0
Morphine	2mg	1	5
	4mg	3	16
	6mg	5	3
	8mg	1	8
	10mg	1	2
Morphine Equivalents		**322**	**608.5**

Table 3. *Discharge prescriptions.*

Drug	**Dosage**	**Total Number of Orders)**	
		Patients w/ ESI (35)	**Patients w/ out ESI (28)**
Oxycodone / Acetaminophen	5/325mg	48	42
	10/325mg	9	14
Hydrocodone / Acetaminophen	5/500mg	2	1
Oxycodone	5mg	3	14
	10mg	2	6
	15mg	0	1
	20mg	0	12
	30mg	0	9
	40mg	0	0
	60mg	0	0
Hydromorphone	2mg	2	23
	4mg	0	0
Morphine Equivalents		**582.5**	**1745**

hydromorphone dose than 2ST patients and 1/3 total dose of morphine while in the ED ($P < 0.0001$). Table 3 shows that upon discharge, 1ESI patients received 1/10 the total hydromorphone prescription dose, and 1/18 the total oxycodone prescription dose ($P < 0.0001$).

While being evaluated in the ED 1ESI reported an average NRS 8.8 (5 – 10, 1.5), and 2ST reported an average NRS 8.89 (4 – 10, 1.77). Pain score on the first day of hospital admission for 2ST was 8.7 (7 – 10, 1.5). ED physicians utilized consultants 3 times for 1ESI and 18 times for 2ST, with 5 patients in group 2ST receiving more than one type of consultant (neurology, neurosurgery, orthopedic surgery, pain management, rehabilitation) ($P < 0.001$). Patients in 1ESI were in pain for 39 days (1 – 300, 71), and 2ST patients were in pain for 6 days (1 – 60, 6) prior to ED visit ($P < 0.01$). Most patients in both groups reported axial pain with radiculopathy, with one in each group reporting axial pain alone. Straight leg testing (SLR) was performed in 6 patients in group 1ESI. Each was positive. SLR was performed in 13 patients in group 2ST, with 8 positive results (62%). All patients in both groups had functional limitation described as limited or inability to ambulate more than a few feet from a stretcher. One patient in each group had (3/5 dorsiflexion) motor weakness in the effected extremity.

Table 4 summarizes the MRI testing that was done in 23 patients in group 1ESI (66%) and 17 (74%) in group 2ST. Of these, 65% were rated as 1 (mild) on the 3-point rating scale described in the methods for group 1ESI and 57% for group 2ST. Eight patients in the 2ST group (35%) received an ESI during the inpatient admission. Total average LOS for 2ST was 5 days (1.5 – 15, 3.3). Five of 8 patients who had an ESI while inpatients were discharged the same day as their injection, 2 were discharged the next day, and one the day after that. One patient from each group returned to the ED with pain within a month of the index ED visit. Both of these were treated with an ESI and discharged. Five patients in 1ESI (14%) received a repeat injection within a month of the index event, and 2 patients had surgery within the one-year follow-up window. No evidence from chart review of surgery or repeat ESI within a year for patients in group 2ST. There were no complications discovered in either group during the one-month follow-up period.

Discussion

An ESI provided immediate and effective pain relief for patients presenting to the ED with severe pain, which was unresponsive to aggressive medical pain management. An ESI decreased total ED dwell time and

Table 4. *MRI grading and abnormalities.*

MRI	1ESI	PCT	2ST	PCT
Total N	35		23	
Total MRI	23	66%	17	74%
Category 1	15	65%	13	76%
Category 2	7	30%	3	18%
Category 3	2	9%	2	12%

Category Description		
Category 1	Mild	Single level mild disease (bulge, annular fissure, absent canal stenosis, foraminal narrowing may be present)
Category 2	Moderate	Same as 1 with multilevel disease
Category 3	Severe	Moderate or severe canal stenosis from large disc herniations, facet or ligament hypertrophy, or multilevel endplate degenerative changes and canal stenosis at multiple levels.

the total dosages of pain medication required while in the ED and provided as discharge prescriptions. Total cost of care for the patients treated with ESI and released was 6.8 times lower than those admitted for pain management. Pain relief was durable, and patients did not require additional ED visits for subsequent pain management.

Rapidly providing adequate pain relief in the ED setting can be challenging. Patients with severe back pain can be particularly difficult to treat. They may require high dose opioids over long time periods to get their pain under sufficient control. Those patients who were treated with oral, IV, or IM medication were discharged with significantly more opioid dosages than the ESI treated cohort. The ESI treated cohort obtained pain relief quickly and without complications, and therefore did not require inpatient admission. When comparing the 1ESI to the 2ST group, the 2ST cohort required 5 inpatient days to achieve adequate pain control to allow safe discharge. Those patients from 2ST that eventually received an ESI were discharged quickly after the injection. ED service utilization measured as total dwell time and consultant utilization was significantly greater in the 2ST group. Service utilization and dwell time may increase overall cost (16).

This retrospective cohort design was not intended to be a definitive test of a management protocol. Although unlikely to account for the total effect, bias in patient selection may account for some of the observed differences. The groups were similar in age, arrival mode, initial pain intensity, pain character, and functional limitation. Those patients with MRIs showed similar degenerative disease in both groups. The most significant difference between the groups was pain duration prior to ED arrival, 39 days for the 1ESI group and 6 days for the 2ST group ($P < 0.02$). The significance of this difference is unclear. Standard of care would lead one to expect those with shortest duration of pain to be most likely to recover. The duration of patient follow-up may also be a limiter. Delays in hospital admission unrelated to patient characteristics may have contributed to increased length of ED stay in those patients in the medical management group. Use of medication to treat those patients selected for ESI may have been intentionally less in anticipation of an ESI. Discharge medication differences may be explained by differences in prescribing patterns of the ED physicians and the inpatient medical teams.

This retrospective cohort comparison showed significant positive impact of ESI when treating patients with refractory pain in the ED. The interlaminar ESI eliminated hospital admissions, lowered ED time, decreased costs, and limited narcotic prescriptions.

References

1. Hart LG, Deyo RA, Cherkin DC. Physician office visits for low back pain. Frequency, clinical evaluation, and treatment patterns from a U.S. national survey. *Spine* 1995; 20:11-19.
2. Andersson GB. Epidemiological features of chronic low-back pain. *Lancet* 1999; 354:581-585.
3. Friedman BW, Chilstrom M, Bijur PE, Gallagher EJ. Diagnostic Testing and treatment of low back pain in United States emergency departments. *Spine* 2010; 35:E1406-E1411. doi:10.1097/BRS.0b013e3181d952a5.
4. Chou R, Qaseem A, Snow V, Casey D, Cross J, Shekelle P, Owens D. Diagnosis and treatment of low back pain: A joint clinical practice guideline from the American College of Physicians and the American Pain Society. *Ann Intern Med* 2007; 147:478-491.
5. Manchikanti L, Abdi S, Atluri S, Balog C, Benyamin R, Boswell M, Brown K, Bruel B, Bryce D, Burks P, Burton A, Calodney A, Caraway D, Cash K, Christo P, Damron K, Datta S, Deer T, Diwan S, Eriator I, Falco F, Fellows B, Geffert S, Gharibo C, Glaser S, Grider J, Hameed H, Hameed M, Hansen H, Harned M, Hayek S, Helm II S, Hirsch J, Janata J, Kaye A, Kaye A, Kloth D, Koyyalagunta D, Lee M, Malla Y, Manchikanti K, McManus C, Pampati V, Parr A, Pasupuleti R, Patel V, Sehgal N, Silverman S, Singh V, Smith H, Snook L, Solanki D, Tracy D, Vallejo R, Wargo B . American Society of Interventional Pain Physicians (ASIPP) guidelines for responsible opioid prescribing in chronic non-cancer pain: Part 2--guidance. *Pain Physician* 2012; 15:S67–116.
6. Okie S. A flood of opioids, a rising tide of deaths. *N Engl J Med* 2010; 363:1981-1985.
7. Ghai B, Bansal D, Kay JP, Vadaje KS, Wig J. Transforaminal versus parasagittal interlaminar epidural steroid injection in low back pain with radicular pain: A randomized, double-blind, active-control trial. *Pain Physician* 2014; 17:277-290.
8. Chang-Chien GC, Knezevic NN, McCormick Z, Chu SK, Trescot AM, Candido KD. Transforaminal versus interlaminar approaches to epidural steroid injections: A systematic review of comparative studies for lumbosacral radicular pain. *Pain Physician* 2014; 17:E509-E524.
9 Manchikanti L, Abdi S, Atluri S, Benyamin RM, Boswell MV, Buenaventura RM, Bryce DA, Burks PA, Caraway DL, Calodney AK, Cash KA, Christo PJ, Cohen SP, Colson J, Conn A, Cordner H, Coubarous S, Datta S, Deer TR, Diwan S, Falco FJ, Fellows B, Geffert S, Grider JS, Gupta S, Hameed H, Hameed M, Hansen H, Helm S, Janata JW, Justiz R, Kaye AD, Lee M, Manchikanti KN, McManus CD, Onyewu O, Parr AT, Patel VB, Racz GB, Sehgal N, Sharma ML, Simopoulos TT, Singh V, Smith HS, Snook LT, Swicegood JR, Vallejo R, Ward SP, Wargo BW, Zhu J, Hirsch JA. . An update of compre- hensive evidence-based guidelines for interventional techniques in chronic spinal pain. Part II: Guidance and recommendations. *Pain Physician* 2013; 16:S49-S283.
10. Manchikanti L, Pampati V, Boswell MV, Smith HS, Hirsch JA. Analysis of the growth of epidural injections and costs in the Medicare population: A comparative evaluation of 1997, 2002, and 2006 data. *Pain Physician* 2010; 13:199-212.
11. Manchikanti L, Falco FJE, Singh V, , Benyamin RM, Racz GB, Helm S, Caraway DL, Calodney AK, Snook LT, Smith HS, Gupta S, Ward SP, Grider JS, Hirsch JA. An update of comprehensive evidence-based guidelines for interventional techniques in chronic spinal pain. Part I: Introduction and general considerations. *Pain Physician* 2013; 16:S1-S48.
12. Rho ME, Tang C-T. The efficacy of lumbar epidural steroid injections: Transforaminal, interlaminar, and caudal approaches. *Phys Med Rehabil Clin N Am* 2011; 22:139-148. doi:10.1016/j.pmr.2010.10.006.
13. Manchikanti L, Singh V, Cash KA, Pampati V, Falco FJE. A randomized, double-blind, active-control trial of the effectiveness of lumbar interlaminar epidural injections in disc herniation. *Pain Physician* 2014; 17:E61-E74.
14. Jarvik JG, Deyo RA. Diagnostic evaluation of low back pain with emphasis on imaging. *Ann Intern Med* 2002; 137:586-597.
15. Bijur PE, Latimer CT, Gallagher EJ. Validation of a verbally administered numerical rating scale of acute pain for use in the emergency department. *Acad Emerg Med* 2003; 10:390-392.
16. Lee MH, Schuur JD, Zink BJ. Owning the cost of emergency medicine: Beyond 2%. *YMEM* 2013; 62:498-505. e3. doi:10.1016/j.annemergmed.2013.03.029.