Trainee Involvement in Transforaminal Epidural Steroid Injections Associated With Increased Incidence of Vasovagal Reactions

Byron Schneider, MD, David J. Kennedy, MD, Ellen Casey, MD, Matthew Smuck, MD, Bryan Conrad, PhD, Christopher Plastaras, MD

Objectives: To evaluate whether trainee involvement (resident and fellow) during transforaminal epidural steroid injections (TFESI) results in greater rates of vasovagal reactions.

Design: Retrospective study on consecutive patients.

Setting: Single academic medical center with multiple attending physicians and trainees.

Participants: A total of 2642 consecutive subjects undergoing 4482 TFESI were analyzed from March 8, 2004, to January 30, 2009.

Main Outcome Measures: The Pearson χ^2 test was used to determine the relationship between vasovagal reactions and level of trainee involvement.

Results: A total of 4482 TFESIs were performed, with 157 (3.5%) of procedures complicated by a vasovagal reaction. An attending physician performed 2884 (64.3%) procedures without trainee involvement, with only 79 (2.7%) vasovagal reaction noted. A fellow was involved in 723 (16.1%) procedures, with 30 (4.1%) noted to have a vasovagal reaction. A resident was involved in 875 (19.5%) procedures, with 48 (5.5%) having a vasovagal reaction. Overall, trainees were involved in 1598 (35.7%) cases, of which 78 (4.9%) were complicated by vasovagal reaction. When a trainee was involved in the case, there was a greater incidence of vasovagal episodes ($P < .001$, $\chi^2 = 16.047$). Although there was a trend towards greater vasovagal rates with residents over fellows, this did not reach statistical difference.

Conclusions: Vasovagal reactions can occur with spine injection procedures and may result in premature procedure termination or other adverse events. Although this retrospective study has significant potential for bias, it appears that trainee involvement in a TFESI is associated with a greater incidence of vasovagal reaction ($P < .001$, $\chi^2 = 16.047$).

PM R 2014;6:914-919

INTRODUCTION

In 2004 there were a total of 1,637,494 epidural, spinal neurolysis, and adhesiolysis procedures performed in the Medicare population [1]. Although serious complications have been reported, in general, these types of interventions have very low complication rates [2-4]. Vasovagal reactions during spine injections frequently are cited as a common immediate adverse event, with a range of reported rates between 0% and 8.7% [5-13]. Vasovagal reactions are thought to occur via an autonomic nervous system response resulting in arterial dilation and bradycardia. In addition to the unpleasant but relatively benign symptoms of vasovagal reactions such as dizziness, diaphoresis, and nausea, vasovagal reactions also may lead to aborted procedures because of hypotension, bradycardia, and, very rarely, asystole [10,14-16].

Risk factors for vasovagal reactions during spine injections are poorly defined. Previous studies have suggested that there is an increased risk of vasovagal reactions in men and those patients younger than 65 years of age [17]. In the surgical literature, trainee involvement is a risk factor for increases in overall morbidity,

B.S. Department of Orthopaedics, Stanford University, Redwood City, CA
Disclosure: nothing to disclose

D.J.K. Department of Orthopaedics, Stanford University, Redwood City, CA. Address correspondence to: D.J.K., 450 Broadway St., Pavilion C, MC 6342 Redwood City, CA 94063; e-mail: djkenned@stanford.edu
Disclosure: nothing to disclose

E.C. Rehabilitation Institute of Chicago, Northwestern University, Chicago, IL
Disclosures outside this publication: grants/grants pending, NIH K-12 grant for unrelated research (money to institution)

M.S. Department of Orthopaedics, Stanford University, Redwood City, CA
Disclosures outside this publication: board membership, ISIS; grants/grants pending, Cytonics Corp, Seikagaku Corp (SKK) (money to institution); payment for lectures, including service on speakers bureaus, NASS Instructional Course Honoraria; travel/accommodations/meeting expenses unrelated to activities listed, NASS Airfare

B.C. Nike Sport Research Lab, Beaverton, OR
Disclosure: nothing to disclose

Author information continued on page 918.

Peer reviewers and all others who control content have no relevant financial relationships to disclose.

Submitted for publication August 7, 2013; accepted April 6, 2014.

Vol. 6, 914-919, October 2014
http://dx.doi.org/10.1016/j.pmrj.2014.04.003

operative time, and complications during hospitalization [18-22]. Data were collected as routine part of medical care with an electronic medical record. The goal of this article and study was to specifically examine the role of trainee involvement. A larger and more extensive multivariate analysis of this cohort has already been done and published [17]. The novel findings in this study are the effects of trainee involvement on the likelihood of a patient developing a vasovagal reaction.

METHODS

This study was a retrospective analysis of an existing prospectively collected dataset that included 2642 consecutive patients treated at a single academic medical center between 2004 and 2009. This study was institutional review board approved at Northwestern University and Health Insurance Portability and Accountability Act of 1996 compliant. Data were collected as routine part of medical care with an electronic medical record. All interventions were performed by the use of fluoroscopic-guidance in either an office-based fluoroscopy suite or ambulatory surgery center by 1 of 4 experienced attending physicians with and/or without trainee involvement. The attending physicians were all board certified in physical medicine and rehabilitation and had additional subspecialty certification in either sports medicine or pain medicine. Residents and fellows in this cohort were solely physical medicine and rehabilitation trainees, as no other medical subspecialties were represented. Resident blocks consisted of 2-month rotations during the postgraduate training years 3 and 4. When present, a fellow usually participated in the procedure. Resident involvement was more variable, and the degree of trainee involvement was at the discretion of the attending physician. Trainees were noted to be involved only if they participated in the interventional portion of the procedure. This participation could be variable and range from anesthetizing the skin to completion of the procedure. The attending's involvement ranged from supervision without being gloved in to hands-on participation with the trainee.

More than 95% of the procedures were performed in an office-based fluoroscopy suite; however, monitoring in this setting was set up to mirror that received in an outpatient surgical center. During the procedure, all patients were actively monitored via continuous pulse oximetry and intermittent automatic blood pressure monitoring by a registered nurse who was positioned at the head of the bed and whose sole responsibility was to monitor the patient. Nurses also kept in verbal communication with the patients to their monitor level of consciousness and to note any symptoms such as nausea. The nurse notified the attending physician if any symptoms were noted. Patients were noted to have a vasovagal reaction by the attending physician if they had a decrease in heart rate and blood pressure in addition to one or more symptom(s) consistent with vasovagal reaction, including lightheadedness, dizziness, palpitations, weakness, dimming or blurred vision, nausea and epigastric distress, feeling warm or cold, facial pallor, and excessive sweating.

Per standard protocol, immediately after the intervention, the treating physician entered all data into a single database using pre-set, drop-down menu choices to facilitate standardized reporting. Baseline demographic and multiple clinical and procedural characteristics were noted, including age, gender, pre- and post-procedure pain scores, type of procedure and target level(s), needle gauge, needle length, fluoroscopy time, termination before completion, and complications. Each of the following complications was included in the drop-down menu choices: vasovagal reaction, intravascular injection, hypertension, intolerable pain, tachycardia, dural puncture, and allergic reaction. Vasovagal reactions were noted only if the reaction occurred after the start of the procedure and before the patient was transferred from the treatment room to recovery. Termination of the procedure was at the sole discretion of the attending physician [17].

Statistical analyses were performed per injection, rather than per patient. To determine the relationship between categorical variables, the Pearson χ^2 test was used. The assumption that the sampling distribution of each variable approximated a χ^2 distribution was checked by ensuring that the expected frequencies in each cell were at least 5. In situations in which sample sizes are less than 5, the Fisher exact test was used. All statistical analysis was performed using SPSS version 20 (IBM Corp.; Armonk, NY). Significance values were set a priori at a level of $P < .05$ [17].

RESULTS

A total of 4482 TFESIs were performed in 2642 consecutive patients. An attending physician performed 2884 (64.3%) procedures without trainee involvement, and only 79 (2.7%) resulted in a documented vasovagal reaction. A fellow was involved in 723 (16.1%) procedures, with 30 (4.1%) noted to have a vasovagal reaction. A resident was involved in 875

Table 1. *Vasovagal rates per level of trainee involved with 95% confidence intervals*

	Vasovagal Reaction	No Vasovagal Reaction
Resident (total n = 875)	n = 48 5.5 ± 1.5%	n = 827
Fellow (total n = 723)	n = 30 4.1 ± 1.5%	n = 693
Resident or Fellow* (total n = 1598)	n = 78 4.8 ± 1.1%	n = 1520
Attending only* (total n = 2884)	n = 79 2.7 ± 0.6%	n = 2805

*Denotes nonoverlapping 95% confidence intervals.