



Impact of Multidisciplinary Spine Conferences on Surgical Planning and Perioperative Care in Elective Lumbar Spine Surgeries

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Study Design: Pre- and post-implementation analysis.

Purpose: We examined the impact of implementing multidisciplinary spine conferences—"spine board" reviews—on the general utilization of elective lumbar spine surgeries in a tertiary medical institute.

Overview of Literature: A multidisciplinary approach to spine care reportedly improves the appropriate utilization of surgical spine procedures.

Methods: A multidisciplinary spine board was established to review candidates selected for elective lumbar spine surgery. The board comprised representatives from orthopedic spine surgery, neurosurgery, psychology, physical therapy, radiology, pharmacy, primary care, pain management, anesthesiology, and veteran advocacy. Two similar 6-month periods were selected to study the impact of this implementation: pre-implementation (June 1, 2015 to November 30, 2015) and post-implementation (June 1, 2016 to November 30, 2016) periods.

Results: Between March 1, 2016 and December 30, 2016, the spine board discussed 11 patients. All patients underwent clinical examinations and radiological assessments findings that warranted elective lumbar surgery. The board recommended non-surgical interventions before proceeding with the planned surgeries in all cases. In the pre-implementation period, a total of 101 elective lumbar spine surgeries were performed. In the post-implementation period, a total of 51 elective lumbar spine surgeries were performed ($p < 0.05$). The surgical plan for elective lumbar spine surgery in the post-implementation period was not directly influenced by the review of spine board because none of the cases were discussed in the conferences; however, the care occurred at a hospital where the spine board was implemented. There was no significant change in the number of cervical spine surgeries performed (66 pre-implementation vs. 56 post-implementation). The average surgery duration was 52 minutes shorter in the post-implementation period compared with that in the pre-implementation period ($p < 0.05$).

Conclusions: Implementation of a multidisciplinary spine board was concurrent with an overall decrease in the utilization of lumbar spine surgeries for elective cases of low back pain in a tertiary medical center.

Keywords: Spine surgery; Multidisciplinary spine conferences; Elective lumbar spine; Health care utilization

Received Sep 29, 2017; Revised Nov 29, 2017; Accepted Jan 5, 2018

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Introduction

According to the biopsychosocial model of chronic low back pain, the successful treatment of chronic low back pain involves correcting the anatomical pathologies causing back pain as well as considering the impact of mental and social issues [1]. As such, a multidisciplinary approach to spine care has been proposed where physical, psychological, emotional, and social aspects of chronic low back pain are addressed by a multidisciplinary team of healthcare providers with diverse expertise [2].

A multidisciplinary approach to spine care should be implemented for two main reasons. First, spine care is often fragmented. Healthcare professionals from multiple specialties, including neurosurgery, orthopedic surgery, interventional pain management, and psychiatry, are involved. These specialists often work independently, evaluate patients based on their own experience and field of expertise, and formulate treatment plans accordingly [3]. Second, spine care is rarely delivered in a consistent manner. Many guidelines have been published by the involved disciplines; however, these guidelines have differences and are not accepted or followed universally [4]. The patients are subject to the “accident of geography” based on the observation that lumbar spine surgery utilization varies by up to eight times across the United States [5]. Therefore, it is not surprising that patients may receive variable recommendations and treatments based on the experience and field of the treating physician [6].

In an attempt to improve the evaluation and management of patients with spine disorders, the Veterans Affairs Maryland Health Care System (VAMHCS) has established a multidisciplinary spine conference referred to as “spine board.” The spine board discussed cases with the highest possibility of poor outcomes after an elective lumbar spine surgery. We hypothesized that such an approach impacted treatment plans and decreased the utilization of elective lumbar surgeries. We expected that this system would affect patients who were discussed in the spine board as well as others whose care occurred at this hospital.

Materials and Methods

A multidisciplinary spine board was created in the VAMHCS (Fig. 1). The spine board was charged with reviewing the care and management of patients whose attending physician was considering lumbar spine surgery for low

back pain. The spine board comprised a team of clinical specialists involved in the care and treatment of spine patients. Representatives from orthopedic spine surgery, neurosurgery, pain psychology, physical therapy, radiology, pain pharmacy, primary care, pain management, anesthesiology, and veteran advocacy were required to attend the monthly spine board meetings. The surgical teams provided a synopsis of the patient’s pertinent history, physical examination findings, imaging, and relevant test results to the board. The surgeon’s discretion was used to decide whether to present a patient’s data to the spine board. The spine board then discussed each patient and made formal recommendations regarding the final treatment plan.

Due to the high volume of spine surgeries performed in the VAMHCS, it was not sustainable to discuss every patient scheduled to undergo elective lumbar spine surgery. The spine board decided to focus its reviews on a select group of patients who had the highest risk of poor outcomes following an elective lumbar spinal surgery. The spine board focused on elective lumbar spine surgeries for two main reasons. First, the indications for cervical spine surgeries, such as myelopathy and radiculopathy, are usually well defined. Second, cervical spine surgeries have very favorable and predictable long-term clinical outcomes [7].

Inclusion criteria was as follows: the multidisciplinary spine board was charged with reviewing the treatment plan for patients with low back pain who were considered for an elective lumbar spine surgery (Fig. 1). The spine board was required to focus its efforts and discussions on patients with one or more of the following criteria: prior lumbar spine surgical interventions; active or recent history of mental health comorbidities; active or recent history of substance abuse disorders (including opioid use disorders); and active Veterans Benefits Administration (VBA) compensation and pension claims. In addition, the board reviewed the following types of patients: those requiring hardware implants or multi-level (three or more levels) lumbar spine surgeries; candidates for a repeat lumbar spine surgery because such patients are known to achieve less satisfactory results postoperatively [8]; and candidates with active VBA compensation and pension claims because secondary gains (like workman’s compensation) are known to influence the success rate of spine surgery [9,10].

Exclusion criteria were as follows: emergent spine cases or spine cases with “red flags”; the red flags included pro-

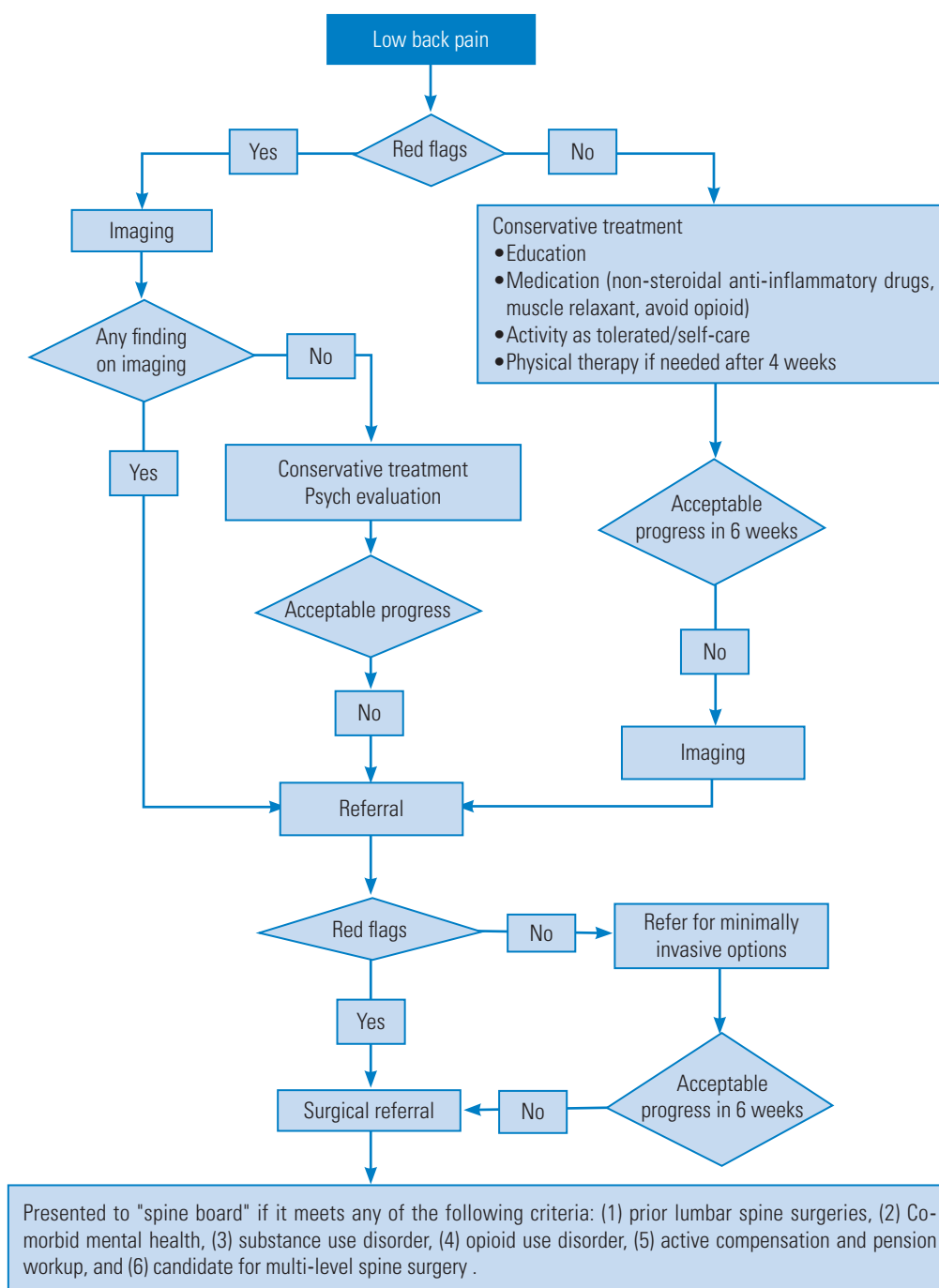


Fig. 1. The chart depicts the management of patients with low back pain in our institute. The "red flags" included progressive lower extremity weakness, bowel or bladder dysfunction, unexplained fever, malignancy, intractable pain, or significant lumbar spine trauma [11].

gressive lower extremity weakness, bowel or bladder dysfunction, unexplained fever, malignancy, intractable pain, or significant lumbar spine trauma [11].

In the present analysis, we evaluated the effect of the review of the spine board on two groups of patients. The patients in the first group were discussed in the spine

board conferences and their care was directly influenced by the spine board. The patients in the second group were not discussed in the spine board conference, but they underwent elective spine surgeries at a medical center where the board was established. The impact of the board on the second group was assessed through the use of retrospec-

tive pre- and post-implementation analyses. Discussions resulting in the creation of the spine board started in December, 2015. The board was officially chartered and began discussing spine cases in March 2016. To ensure no pre-implementation bias, the period between June 1, 2015, and November 30, 2015, was selected as the pre-implementation period; an identical period in 2016 (June 1, 2016, to November 30, 2016) was selected as the post-implementation period. The University of Maryland Institutional Review Board (IRB) reviewed this retrospective quality improvement project and determined that it did not require an IRB review, and therefore waived the need for informed consent.

For the purpose of surgical volume, cases planned to undergo elective spine surgeries were divided into three categories based on the anatomical status, comprising cervical, thoracic, and lumbar regions. Cervical cases extending to the upper thoracic vertebral levels T1 and T2 were categorized as cervical spine surgeries; thoracic cases were limited to the thoracic spine; and lumbar cases that extended to the lower thoracic T11 and T12 were categorized as lumbar spine surgeries.

The patients' demographics (age, sex, body mass index, and smoking status) were extracted from the preoperative records. The following data were collected and aggregated from surgical record review: surgery duration, estimated blood loss, packed red blood cell transfusion, destination after surgery, and length of intensive care unit (ICU) and/or hospital stay. These medical records were accessed in the VAMHCS computerized patient record system, the electronic health record software of the Department of Veterans Affairs. Data from Veterans Affairs Surgical Quality Improvement Program were used to assess surgical complications (including surgical site infection, thromboembolic events, urinary tract infection, and peripheral nerve injury).

Categorical variables were compared using Pearson's

chi-square test. Continuous data were compared using two-tailed Student *t*-test. The variables, number of red blood cell units transfused, and length of hospital and/or ICU stay were compared using a non-parametric Mann-Whitney *U*-test. Stata SE ver. 14.2 (Stata Corp., College Station, TX, USA) was used for statistical analyses.

Results

The VAMHCS spine board was established in March 2016. Between April 1, 2016 and December 30, 2016, 11 patients were discussed by the board. All patients were planned to undergo elective lumbar surgical procedures for low back pain. The board recommended non-surgical interventions in all cases. The recommended interventions included smoking cessation, weight reduction, mental health evaluation, and interventional pain procedures. Only one of these patients ultimately received an elective spine surgery after the board recommendations were fulfilled. The final surgical procedure was less invasive than the original plan.

In the pre-implementation period (June 1, 2015 to November 30, 2015), a total of 174 elective spine surgeries were performed, 101 (58%) of which were lumbar spine surgeries. In the post-implementation period (June 1, 2016 to November 30, 2016), a total of 117 elective spine surgeries were performed, 51 (44%) of which were lumbar spine surgeries (chi-square=6.8961, $p<0.05$) (Table 1). The number of elective cervical surgeries in the pre-implementation period (66 cases) was comparable to that in the post-implementation period (56 cases).

The results from the pre-implementation and post-implementation analyses are summarized in Table 2. In the post-implementation period, only 35% of the patients were smokers; this percentage was significantly lower compared with that in the pre-implementation period (52%, $p<0.05$). Further, the mean surgery duration decreased by 52 minutes on an average in the post-

Table 1. The numbers of the surgical procedures that was performed in pre-implementation (June 1, 2015 to November 30, 2015) and post-implementation (June 1, 2016 to November 30, 2016) period

| | Pre-implementation | Post-implementation | Total |
|----------|--------------------|---------------------|-------|
| Cervical | 66 (38) | 56 (48) | 122 |
| Lumbar | 101 (58) | 51 (44) | 152 |
| Thoracic | 7 (4) | 10 (9) | 17 |
| Total | 174 | 117 | 274 |

Values are presented as number (%). Only the change in number of lumbar spine surgeries was significantly decreased post-implementation.

Table 2. The demographic and the surgical time and hospital indices for the patients who had elective lumbar spine surgeries during pre-implementation period (June 1, 2015 to November 30, 2015) and post-implementation period (June 1, 2016 to November 30, 2016)

| Characteristic | Pre-implementation | Post-implementation | <i>p</i> -value |
|--------------------------------------|-----------------------|-----------------------|-----------------|
| No. of surgeries | 101 | 51 | |
| Male sex | 93 (92) | 46 (90) | 0.659 |
| Body mass index (kg/m ²) | 30.88±5.5 | 31.33±4.6 | 0.619 |
| Smoker | 53 (52) | 18 (35) | 0.045 |
| Age (yr) | 59±12 | 57±13 | 0.400 |
| Surgical time (min) | 283±133 | 231±132 | 0.024 |
| Estimated blood loss (mL) | 792±906 | 657±868 | 0.382 |
| No. of revision cases | 28 (27) | 10 (20) | 0.275 |
| Implants | 71 (70) | 30 (59) | 0.157 |
| No. of levels fused | 2.2±1.3 | 1.8±1.3 | 0.141 |
| Transfusion (pRBC) | 29 (29) | 8 (16) | 0.077 |
| No. of pRBC units | 2.8±1.8 (in 29 cases) | 4.1±2.7 (in 8 cases) | 0.122 |
| Extubated in the operating room | 75 (74) | 42 (82) | 0.263 |
| Destination: ICU | 76 (75) | 33 (65) | 0.173 |
| Stay in ICU (day) | 3.3±3.9 (in 76 cases) | 3.1±2.9 (in 33 cases) | 0.537 |
| Hospital stay (day) | 7.0±6.4 | 8.9±13.9 | 0.268 |
| Destination: home | 80 (79) | 44 (86) | 0.289 |
| Postoperative complications | 10 (9.9) | 3 (5.9) | 0.395 |

Values are presented as number (%) or mean±standard deviation.
pRBC, packed red blood cell; ICU, intensive care unit.

implementation period ($p=0.024$). The trends of change in other variables, such as the length of stay or transfusion of blood products, were not significantly different between the pre- and post-implementation periods.

There was no significant change in postoperative complications between the pre- and post-implementation periods. There were two surgical site infections, five thromboembolic events, and three urinary tract infections in the pre-implementation period. There was only one thromboembolic event and two peripheral nerve injuries in the post-implementation period.

Discussion

Multidisciplinary spine conferences, or "spine board", were established and sustained at a major medical center. Our results indicated that the spine conferences influenced treatment plans of patients as well as the general spine surgical planning for several other patients whose treatments occurred at facility where the board was established. For all 11 patients who were discussed in the

spine board conference, the board recommended further non-surgical treatments before elective lumbar spine surgery. In the pre-implementation period, all these patients would have undergone the planned surgery, which would not have been an effective initial treatment in any of the cases.

Our analysis showed that implementing spine board reviews was associated with the decreased utilization of elective lumbar spine surgeries. In our analysis, not all patients selected for elective lumbar spine surgeries were discussed in the board. Therefore, the board discussion did not directly influence decision making in all the surgeries performed. Several factors may explain the association between the decreased utilization of lumbar spine surgeries and the implementation of spine board reviews. First, close communication occurred among the members, particularly between the mental health specialists and the surgical teams. The collaboration started in the monthly spine board meetings and extended throughout the enterprise. More thorough mental health screening at the surgical clinics could have led to better patient selection.

Second, the observer (Hawthorne) effect, an inherent bias between pre- and post-implementation studies, may have occurred [12]. Third, the ongoing overall improvement in the VAMHCS system may have improved spine care from the pre- to the post-implementation period.

Multidisciplinary spine evaluations have been shown to decrease the utilization of surgical procedures and imaging services [6,13-15] with minimal adverse effects on the quality of spine care [14]. In a recent study, multidisciplinary conferences reviewed 100 patients for whom spine surgeries were recommended. The conferences recommended non-operative management in 58 of these patients [6]. In another study in Denmark, the presence of non-surgical clinics resulted in a decreased rate of lumbar disc surgery [14].

The decreased utilization of elective lumbar spine surgeries is believed to improve health care delivery for several reasons. First, the results of the conservative management of several lumbar spine pathologies are comparable to those of surgery [16-18]. Second, surgeries may not always be successful. Chronic pain exists in at least 20% of patients undergoing spine surgeries [19,20]. Third, surgery is associated with some significant complications. The rate of major postoperative surgical complications was 6%–10% in the present study and is reported to be 10%–24% in general [18]. Fourth, elective spine surgeries are expensive and consume significant resources [3]. Therefore, it can be concluded that a multidisciplinary spine board can improve spine care utilization. Moreover, the implementation of spine board reviews was also coincident with decreased surgery duration and a trend toward a less intensive surgical approach. This was not expected and contrasts with the previous reports. The introduction of multidisciplinary approaches has been reported to decrease surgical volume but to increase the general intensity of the surgeries because patients with milder conditions will be mainly treated via conservative management. In a recent study, a single visit to a physiotherapist prior to non-urgent spine surgical consultations, as required by the insurer, caused a decrease in the general rate of lumbar spine surgeries, while the percentage of fusion surgeries increased [13]. This observed decreased intensity in the surgical approach may have been due to optimized surgical planning.

Traditionally, multidisciplinary spine care has been integrated by conducting either multidisciplinary spine conferences and/or by establishing specialized spine cen-

ters. The ideal methodology includes a discussion of all patients in such multidisciplinary conferences. However, this may not always be feasible since such discussions demand significant time and commitment from multiple clinical providers in various disciplines. Another multidisciplinary approach is the establishment of specialized spine centers. Such centers were established in several major medical centers to improve communication among the specialties involved [21,22]. These centers are convenient for patients because they reduce or eliminate travel requirements to different locations for various ancillary services (such as imaging and physical therapy among others). Unfortunately, small-to-medium size health care organizations may not afford the establishment of such a dedicated spine center.

The spine board, which only discusses selected groups of patients, provides a practical and sustainable model. This model offers two advantages over the spine centers. First, many medical centers cannot afford to restructure to form a major comprehensive spine center [21,22], while implementing spine board reviews is easily done with minimal efforts. Second, the close proximity of the providers in spine centers encourages communication but does not guarantee it. The spine board model ensures that a productive discussion occurs among diverse groups of healthcare providers.

A pre/post-implementation study is inevitably biased by temporal changes over the 6 months between the pre- and post-implementation periods. However, the general spine care in our institute was similar in the pre- and post-implementation periods because the volume of cervical spine surgeries did not change between these periods.

The main limitation of our study is its retrospective pre/post-implementation design. The spine board was established in our institute and our study analyzed its effect retrospectively. Due to the importance of a multidisciplinary approach in spine care, we did not find it ethical to conduct a randomized controlled trial. It is also not possible to blind the clinicians. Another limitation is the limited sample size. The low sample size did not allow enough statistical power to evaluate the significance of the observed trends. Further, a selection bias existed because the surgical teams voluntarily presented cases with the highest possibility of poor outcome to the spine board. These patients might not have been suitable surgical candidates.

Our results cannot address the question whether multidisciplinary spine conferences affect the long-term out-

comes of spine surgeries. We did not find any changes in the immediate operative complication rates between the pre- and post-implementation periods. However, further studies are warranted to examine the effect of the multidisciplinary approach on the long-term outcomes of spine surgeries.

The spine board offered other benefits to our institute. It facilitated discussions on imaging utilization, improved surgical referrals and patient flow, and contributed to better pain management. Moreover, the board created educational value—one of the core values at the Veterans Affairs system. All participants continued to learn the subject matter based on their expertise. Trainees from different disciplines also attended the spine board reviews.

Conclusions

Multidisciplinary spine spine board “spine board” reviews were successfully implemented and sustained in the VAMHCS. The present retrospective analysis demonstrated that the spine board reviews were coincident with the decreased utilization of elective lumbar surgeries. This model provides a sustainable model that can be easily implemented in several centers. Further studies are warranted to explore the impact of the spine board on the long-term clinical outcomes of spine surgeries.

Conflict of Interest

No potential conflict of interest relevant to this article was reported.

Acknowledgments

The contents do not represent the views of the U.S. Department of Veterans Affairs or the United States Government. The authors acknowledge the support from the Department of Veterans Affairs as well as the VA Maryland Health Care System.

The authors would like to thank Sylvia Ayers, Catherine Fronc, Debra Khani-Mevorach Eugene Koh, Robert Lavin, Michelle Likas, Arianna Perra, Marc Simard, and Douglas Turner in establishing the spine board. The authors would also like to thank Tushana Fowlin, Johnny Gayden, Lindsay Koodaly, Eva McDonald, Seenia Mathew, Sheeba Paranilam, and Nancy Walsh for their assistance in data collection.

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