Safety of Continuous Low-Dose Aspirin Therapy for Lumbar Decompression Alone

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Abstract:

Introduction: Whether the benefits of continued perioperative aspirin therapy in spinal surgery outweigh the risk of perioperative complications remains unclear. This study evaluates the perioperative effects of continuous low-dose aspirin treatment in patients who underwent lumbar decompression alone.

Methods: This single-institute retrospective study included patients who underwent lumbar decompression for L1/2-L5/S1 lesions. The patient characteristics, perioperative parameters, and complications were compared between 103 patients who continued to take 100 mg/day aspirin during the perioperative period (aspirin group) and 653 patients who did not take antiplatelet or anticoagulant drugs (nonaspirin group).

Results: A significantly higher proportion of the patients in the aspirin group were males. The patients in the aspirin group had significantly lower preoperative hemoglobin levels than those in the non-aspirin group (P=0.001 and P=0.044, respectively). No significant differences were detected between the groups in terms of the number of disc decompression levels, duration of surgery, intraoperative blood loss, postoperative drainage volume, number of reoperations required for epidural hematoma formation, or perioperative blood transfusions. No cardiovascular or cerebrovascular ischemic events occurred in either group.

Conclusions: Continuous low-dose aspirin therapy alone during the perioperative period for lumbar decompression did not increase perioperative bleeding or the risk of bleeding-related complications. In conclusion, continuous low-dose aspirin treatment may be acceptable for use in preventing the increased risk of cardiovascular disease caused by aspirin withdrawal in patients undergoing lumbar decompression.

Keywords:

antiplatelet drug, epidural hematoma, low-dose aspirin, lumbar decompression, perioperative bleeding, perioperative complication, perioperative infusion, spine surgery

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Introduction

Aspirin is the most widely recognized and used antiplatelet agent for the primary and secondary prevention of cardiovascular disease[1-6]. Therefore, if the benefits of continuing aspirin usage outweigh the risks associated with bleeding, medication should be continued during the perioperative period[5,6]. However, no appropriate guidelines for the continued administration of aspirin during the perioperative period for spinal surgery have yet been set. With aspirin being discontinued before surgery, spine surgery is performed based on the possibility that the platelet coagulation ability will return to normal after approximately 7 days of aspirin discontinuation[7] to avoid perioperative bleeding and nerve damage caused by postoperative epidural hematoma[8-13]. Currently, the decision to continue or discontinue low-dose aspirin in patients undergoing spine surgery is made by surgeons on a case-to-case basis. In other cases, arrangements are made for each facility[14,15].

In recent years, due to concerns on the risk of perioperative cardiovascular events associated with aspirin withdrawal[16], studies on the safety of continuing low-dose aspirin administration during the perioperative period of spinal surgery were conducted[17-24]. Some of these studies reported on the continuation of perioperative aspirin treatment in cervical spine decompression surgery[22,23]. However, most of

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these previous works focused on fusion techniques for lumbar spine surgery[8,9,18,19], and there were only a few studies discussing conventional decompression techniques[17]. This study aims to evaluate the effects of continuous low-dose aspirin treatment in patients who underwent lumbar decompression alone.

Materials and Methods

This study was approved by our institutional review board. Due to the retrospective nature of this work, we used an opt-out approach instead of obtaining consent for data collection from individual patients.

This retrospective study was conducted at a single facility using data taken from electronic medical records. We extracted the data of 2,234 patients who underwent posterior decompression for lumbar lesions associated with degenerative spondylotic disease or ossification of the posterior longitudinal ligament or ligamentum flavum, excluding idiopathic epidural hematomas, infections, tumors, and trauma, between January 2012 and April 2023. Only those who underwent decompression treatment for lesions at the L1/2-L5/S1 level were included in this study. Patients who underwent endoscopic surgery, herniectomy, discectomy, or revision surgery for the same lesion were excluded. We limited the resection to the dorsal elements of the dura and nerve roots to simplify and homogenize the surgical technique and minimize the effects of bleeding from the epidural venous plexus. Dialysis patients were excluded as well because they generally tend to bleed easily and have a low hematopoietic ability, thereby posing a higher risk of postoperative epidural hematoma and perioperative blood transfusion compared to patients not undergoing dialysis. Patients taking clopidogrel, cilostazol, ethyl eicosapentaenoate, prostaglandin E1, sarpogrelate, warfarin, dabigatran, apixaban, edoxaban, or rivaroxaban were also excluded. Additionally, we excluded patients who developed an intraoperative dural injury or a postoperative cerebrospinal fluid leakage because treatment of the damaged dura mater increases the surgical time, and the cerebrospinal fluid leakage during and after surgery may increase the intraoperative blood loss and the postoperative waste fluid volume. In contrast, the cerebrospinal fluid pressure that decreased due to cerebrospinal fluid leakage may increase the bleeding from the epidural venous plexus and affect the intraoperative blood loss. We excluded patients younger than 56 years to exclude older age as a confounding factor for aspirin treatment. The minimum age of low-dose aspirin users who met the inclusion criteria for this study was 56 years. A total of 756 patients were divided into two groups as follows: low-dose aspirin group (aspirin group, n=103) and non-aspirin group (nonaspirin group, n=653; Fig. 1). In the aspirin group, only patients taking low-dose aspirin (100 mg/day) were included. Patients taking aspirin at other doses and those taking antiplatelet or anticoagulant drugs other than aspirin were excluded. The characteristics, perioperative parameters, and perioperative complications of the two groups were then compared and examined.

All surgeries were performed by one of the seven hospital surgeons. Fenestration was performed in most cases, while total laminectomy was performed in a few. The intraoperative blood pressure was controlled at the anesthetist's discretion. However, when the surgeon felt that there was more bleeding than usual, and that the surgery was difficult to perform, he checked the patient's blood pressure and requested for it to be lowered as much as possible. A sheet-type microfibrillar collagen hemostatic agent was used to achieve hemostasis at the surgeon's discretion. In most cases, only one postoperative closed suction drainage tube was placed. In cases involving skip lesions, only one tube was placed for each lesion, as well. At the surgeon's discretion, two tubes were sometimes placed for decompression at the four-disk level. If the drainage volume was ≤100 mL within 24 h, the drainage tube was removed 2 days postoperatively; otherwise, the tube was removed at the surgeon's discretion.

The examined patient characteristics were sex, age at surgery, body mass index, and medical history/comorbidities (hypertension, diabetes, angina, myocardial infarction, cerebral infarction, and history of coronary stenting or coronary artery bypass surgery). The perioperative parameters examined included the perioperative hemoglobin level, activated partial thromboplastin time, albumin level, estimated glomerular filtration rate, number of disk decompression levels, duration of surgery, intraoperative bleeding volume, postoperative drainage volume, and length of hospital stay. The investigated postoperative complications included the postoperative epidural hematoma rates requiring additional surgery, perioperative blood transfusions, postoperative infections requiring additional surgery, and other notable perioperative complications. The clinical results were excluded from the evaluation because of a high proportion of missing Japanese Orthopedic Association scores.

To evaluate the effects of continuing or discontinuing aspirin treatment, the patients receiving aspirin treatment were divided into two groups: 1) those who continue treatment; and 2) those who discontinue treatment. However, this was a retrospective study, and there were no cases of aspirin withdrawal. Therefore, for convenience, patients who did not receive antiplatelet or anticoagulant therapy were included in the target group instead of the aspirin withdrawal group.

A statistical analysis was performed using EZR 64-bit version 1.60 (http://www.jichi.ac.jp/saitama-sct/SaitamaHP.files/statmed.html)[25]. The continuous variables were compared using the Mann-Whitney U test, while the categorical ones were compared using Pearson's Chi-squared test or Fisher's exact test. The statistical significance was set at $P<0.05$.

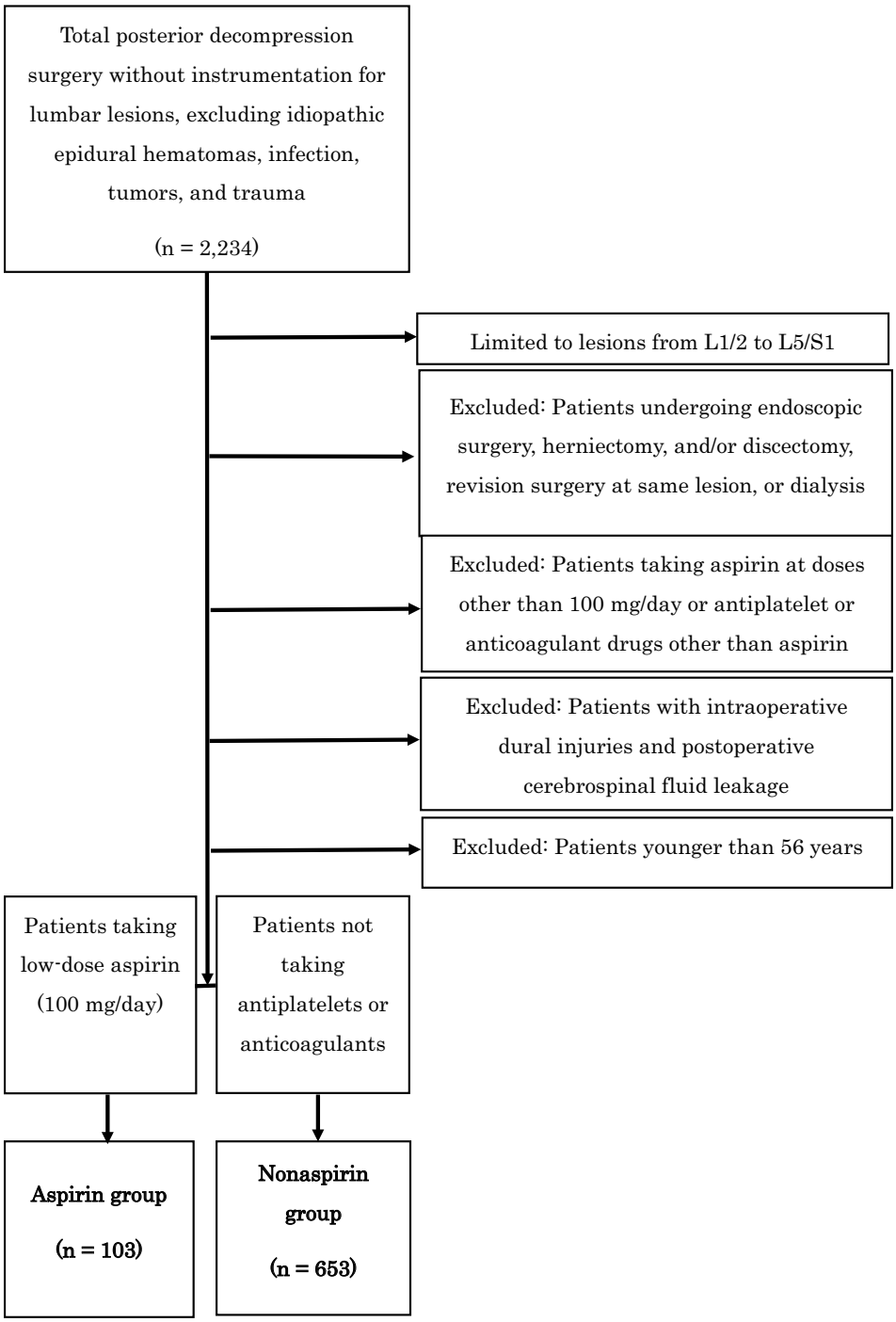

Figure 1. Flowchart of the patient selection process used in this study.

Results

Patient characteristics

The male-to-female ratio was significantly higher in the aspirin group than in the non-aspirin group (P=0.001). Similarly, the median body mass index was significantly higher in the aspirin group (25.2 kg/m^2; range, 18.3-34.8 kg/m^2) than in the non-aspirin group (24.6 kg/m^2; range, 15.0-39.1 kg/m^2; P=0.048). No significant difference in the median age was observed between the two groups (Table 1).

Comorbidities

The prevalence or history of hypertension, diabetes, angina, myocardial infarction, cerebral infarction, coronary stenting, and coronary artery bypass surgery was significantly higher in the aspirin group than in the non-aspirin group (Table 1).

Preoperative parameters

The preoperative hemoglobin level was significantly lower in the aspirin group than in the nonaspirin group (P=0.044; Table 2). The preoperative activated partial thromboplastin

Table 1. Characteristics of Patients Undergoing Lumbar Decompression Alone.

	Aspirin group (n=103)	Nonaspirin group (n=653)	P value
Sex, male:female	76:27	372:281	0.001*
Age, years	75 (56–89)	74 (56–93)	0.134
BMI, kg/m^2	25.2 (18.3–34.8)	24.6 (15.0–39.1)	0.048*
Comorbidities			
Hypertension	81 (78.6%)	443 (67.8%)	0.029*
Diabetes	38 (36.9%)	142 (21.7%)	0.002*
Angina	37 (35.9%)	25 (3.8%)	<0.001*
Myocardial infarction	29 (28.2%)	2 (0.3%)	<0.001*
Cerebral infarction	32 (31.1%)	15 (2.3%)	<0.001*
Coronary stenting or coronary artery bypass surgery	42 (40.8%)	8 (12.3%)	0.001*

Data are presented as n, median (range), or n (%).
*Statistically significant difference.
BMI, body mass index

Table 2. Perioperative Data of Patients Undergoing Lumbar Decompression Alone.

	Aspirin group (n=103)	Nonaspirin group (n=653)	P value
Preoperative parameters			
Hemoglobin level, g/dL	13.5 (10.4–17.6)	13.9 (8.7–19.0)	0.044*
APTT, s	27.3 (19.9–57.6)	26.5 (9.3–51.8)	0.004*
Albumin level, g/dL	4.2 (3.1–4.8)	4.2 (2.4–5.3)	0.327
eGFR, mL/min/1.73 m^2	59.9 (29.4–110.3)	64.9 (5.8–178.1)	0.028*
Intraoperative parameters			
Number of decompressed Intervertebral disk levels	2 (1–4)	2 (1–4)	0.468
Duration of surgery, min	83 (32–237)	80 (30–257)	0.173
Intraoperative blood loss, mL	30 (3–250)	25 (2–535)	0.259
Postoperative parameters			
Postoperative drainage volume, mL	228 (40–1214)	213 (0–1164)	0.121
Hemoglobin level, g/dL	12.1 (8.4–17.1)	12.5 (7.3–17.3)	<0.05*
One day after surgery			
Hemoglobin level, g/dL	12.0 (8.4–17.5)	12.6 (7.4–16.9)	0.005*
Three days after surgery			
Hemoglobin level, g/dL	11.9 (8.3–16.5)	12.3 (7.4–16.0)	0.011*
Seven days after surgery			
Others			
Hospital stay, days	17 (10–62)	16 (9–60)	0.479

Data are presented as median (range).
*Statistically significant.
APTT, activated partial thromboplastin time; eGFR, estimated glomerular filtration rate

time was significantly higher in the aspirin group than in the non-aspirin group (P=0.004). The preoperative estimated glomerular filtration rate was significantly lower in the aspirin group than in the non-aspirin group (P=0.028). Meanwhile, the preoperative albumin levels were similar between the two groups (Table 2).

Intraoperative parameters

The number of disc decompression levels, surgery duration, and amount of intraoperative blood loss were not significantly different between the aspirin and non-aspirin groups (P=0.468, P=0.173, and P=0.259, respectively; Table 2).

Postoperative parameters

The postoperative drainage volumes in the aspirin and non-aspirin groups were similar (P=0.121; Table 2). The postoperative hemoglobin levels were significantly lower in the aspirin group over time, similar to the preoperative findings (Table 2).

Other parameters

No significant difference was observed in the median length of hospital stay between the aspirin and nonaspirin groups (P=0.479; Table 2).

Table 3. Perioperative Complications in Patients Undergoing Lumbar Decompression Alone.

	Aspirin group (n=103)	Nonaspirin group (n=653)	P value
Number of reoperations for epidural hematoma	0 (0.0)	1 (0.2)	>0.999
Blood transfusion rate	0 (0.0)	3 (0.5)	>0.999
Number of reoperations for surgical site infection	1 (1.0)	2 (0.3)	0.356

Data are presented as n (%).

Perioperative complications

The reoperation rates for epidural hematoma, perioperative blood transfusion, and surgical site infection were similar between the aspirin and non-aspirin groups (P>0.999, P> 0.999, and P=0.356, respectively; Table 3). No cardiovascular or cerebrovascular ischemic events occurred in either group.

Discussion

The present study demonstrated that the continuation of low-dose aspirin therapy in patients who underwent lumbar decompression alone did not increase the amount of perioperative bleeding, rate of reoperation for postoperative epidural hematomas, or perioperative blood transfusions. No previous study investigated the effect of low-dose aspirin (100 mg/day) on the perioperative bleeding volume and the perioperative bleeding-associated complications in patients who underwent lumbar decompression only, with the resection limited to the dorsal elements of the dura and nerve roots and the decompression levels limited to those in the L 1/2-L5/S1 regions.

Similar results have been reported in recent years. Park et al.[18] reported that in lumbar decompression and fixation surgery, there were no differences in the operation time, perioperative blood loss, or perioperative complications among the non-aspirin treatment group, perioperative discontinuation of the aspirin treatment group, and perioperative aspirin treatment group. Cuellar et al.[19] compared 100 patients each in a group that continued aspirin treatment and a group that withdrew aspirin and showed similar results, but did not evaluate the amount of postoperative bleeding[26]. Differences were observed between the two groups in terms of the surgical site, number of surgical intervertebral spaces, and surgical method. Soleman et al.[17] compared 40 patients who continued aspirin treatment perioperatively with 62 patients who discontinued aspirin treatment 1 week before surgery during non-instrumented lumbar decompression surgery. They found no differences between the two groups in terms of the operative time, perioperative blood loss, mean postoperative blood transfusion volume, or incidence of postoperative complications. Although our patients underwent up to four intervertebral decompressions and did not include any case of herniotomy, their patients underwent up to three intervertebral decompressions and included cases of microscopic herniotomy. Tarukado et al.[21] performed endoscopic laminectomy at one level in 65 patients who did not receive aspirin therapy, nine patients who discontinued low-dose aspirin therapy preoperatively, and 14 patients who continued low-dose aspirin therapy and found no significant differences in terms of the surgical time, intraoperative blood loss, or perioperative complications between the three groups. However, compared to the current study, the evaluations involved less invasive surgical treatment and fewer cases.

Some studies reported results different from ours when comparing patients who did not receive aspirin treatment to those who discontinued aspirin treatment perioperatively[7,8]. However, these studies did not include patients in whom aspirin administration was continued during the perioperative period. In addition, a systematic review[24] that included one of these studies found that continued aspirin treatment did not increase the surgery duration, intraoperative bleeding volume, or risk of blood transfusions. This finding is consistent with the results of this study.

This study has the following limitations: first, this was a retrospective single-institute study; second, direct comparisons between patients who continued aspirin and those who discontinued aspirin in the perioperative period were not performed; thus, the risk of cardiovascular disease when aspirin was withdrawn during the perioperative period of lumbar decompression cannot be assessed; third, the confounding factors associated with aspirin treatment cannot be excluded, but those of hypertension, diabetes, heart disease, anemia, and chronic kidney disease are risk factors for perioperative complications[27-30]; therefore, these indices would have had a more unfavorable effect on patients in the aspirin group compared to those in the non-aspirin group; fourth, because perioperative complications, including perioperative cardiovascular disease and postoperative epidural hematoma, relatively infrequently occur, the sample size in the current study may have been too small for statistical analysis because the incidence rate of myocardial infarction after lumbar spine surgery is only 0.43%[31], and that of symptomatic postoperative epidural hematoma is only 0.1%-0.24%[32]. The blood pressure control and hemostasis procedures clearly affect the amount of perioperative blood loss and the formation of postoperative epidural hematomas, but we did not adequately evaluate or investigate this in this work. Therefore, in the future, multicenter studies with larger sample sizes that evaluate bleeding-related factors, such as perioperative blood pressure, and divide aspirin-treated patients into perioperative continuation and discontinuation groups

should be conducted.

This study found no differences in the intraoperative blood loss or postoperative drainage between the aspirin and non-aspirin groups. Generally, when a blood vessel is injured, it contracts, and the platelets aggregate and close the injured area, thereby completing primary hemostasis. Furthermore, the coagulation system is activated, and a fibrin network is formed around it, completing secondary hemostasis. Even if the aggregation ability of the platelets is reduced, a secondary hemostasis can be achieved without problems if the coagulation system is activated in the microvessels. Even for larger blood vessels, if primary hemostasis can be achieved with compression, thermal coagulation, or a hemostatic agent, we may not find an effect on intra-or postoperative bleeding, unless the coagulation system is abnormal. We believe that the same applies to other antiplatelet agents. Although the number of cases is small, clopidogrel is continued in the perioperative period of cervical and lumbar spine surgeries without any particular problems (data not shown). Abnormal coagulation and anticoagulant therapy are generally considered as risk factors for the epidural hematoma formation[11,28]. However, antiplatelet drugs and anticoagulants have yet to be distinguished in previous discussions, despite their completely different action mechanisms. Therefore, these two drugs should be evaluated separately.

Lumbar decompression, which involves the removal of only the dorsal elements, is a relatively minimally invasive procedure with minimal perioperative blood loss. Therefore, the benefits of preventing perioperative cardiovascular disease may outweigh the risk of the perioperative complications associated with continued aspirin therapy.

Conflicts of Interest: The author declares that there are no relevant conflicts of interest. The submitted manuscript contains no information about medical devices or drugs.

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Ethical Approval: The Institutional Review Board of Kumamoto Chuo Hospital approved this study (Approval No. 202401-04).

Informed Consent: We used an opt-out approach instead of obtaining consent from individual patients because of the retrospective nature of this study.

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