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Editorial

When and if to stop low-dose aspirin before spine surgery?

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Abstract

Background: Prior to spine surgery (SS), we ask whether and when to stop low-dose aspirin (LD-ASA), particularly in patients with significant cardiovascular disease (CAD). Although platelets typically regenerate in 10 days, it can take longer in older patients.

Methods: Here we reviewed several studies regarding the perioperative risks/complications [e.g. hemorrhagic complications, estimated blood loss (EBL), continued postoperative drainage] for continuing vs. stopping LD-ASA at various intervals prior to lumbar SS.

Results: Multiple studies confirmed the increased perioperative risks for continuing LD-ASA throughout SS, or when stopping it for just 3–7 preoperative days; however, there were no increased risks if stopped between 7 to 10 days postoperatively. Other studies documented no increased perioperative risk for continuing LD-ASA throughout SS, although some indicated increased morbidity (e.g., one patient developed a postoperative hematoma resulting in irreversible paralysis).

Conclusions: Several studies demonstrated more hemorrhagic complications if LD-ASA was continued throughout or stopped just 3 to up to 7 days prior to SS. However, there were no adverse bleeding events if stopped from 7–10 days preoperatively. As a spine surgeon who wishes to avoid a postoperative epidural hematoma/paralysis, I would recommend stopping LD-ASA 10 days or longer prior to SS. Nevertheless, each spine surgeon must determine what is in the "best interest" of their individual patient. Certainly, we need future randomized controlled trials to better answer: when and if to stop LD-ASA before spine surgery.

Key Words: Bleeding complications, cardiac risk, hemorrhagic sequelae, low-dose aspirin, perioperative spine surgery, postoperative drainage, prophylaxis

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INTRODUCTION

For patients on low-dose aspirin (LD-ASA) (e.g., 81–100 mg) prophylaxis for cardiovascular disease (CAD) (e.g., stents, bypasses, other), spine surgeons frequently confront whether or when to stop therapy prior to spine surgery (SS). Platelets typically regenerate in 10 days, although it may take longer for older patients. In this editorial and focused review of the literature, we briefly compared the perioperative risks/complications [e.g., hemorrhagic complications, estimated blood loss (EBL), continued postoperative drainage] for continuing vs. discontinuing (e.g. stopping LD-ASA from 3-<7 and from 7-10 days) LD-ASA at different intervals prior to lumbar SS.

Part 1: Increased perioperative bleeding risks using low-dose aspirin (LD-ASA) for spine surgery [Table 1]

Increased perioperative bleeding risks when low-dose aspirin was continued or not stopped long enough prior to lumbar spine surgery

Several series documented the increased perioperative risks/complications (e.g., hemorrhagic complications, EBL, continued postoperative drainage) when LD-ASA was continued and/or stopped for just 3 up to 7 days preoperatively vs. finding no such risks for LD-ASA stopped for 7–10 (average 9) preoperative days.[4,5] For patients undergoing 1-level lumbar fusions in Kang *et al*. (2011), Group 0 were on no LD-ASA, whereas Group 1 patients stopped LD-ASA (100 mg) at least 7 days (average 9 days) preoperatively. Although both groups demonstrated comparable intraoperative bleeding, Group 1 patients showed more postoperative bleeding, greater estimated postoperative blood loss, more drainage, and higher transfusion requirements [Table 1].[4] Park *et al*. (2013) evaluated the hemorrhagic complications for patients undergoing 1–2 level lumbar fusions on no ASA (Group 0) vs. LD-ASA stopped 3–7 days (Group 1) vs. LD-ASA stopped 7–10 days (Group 2) preoperatively [Table 1].[5] Cessation of LD-ASA 7–10 days preoperatively in Group 2 patients resulted in no significant increased bleeding risks when compared with those on no LD-ASA (Group 0). However, more bleeding risks/complications were observed for Group 1 patients where LD-ASA was just stopped 3–7 days prior to surgery.

Table 1: Increased risks for continuing low-dose aspirin for spine surgery

Author [Ref] year	Patient sample	Operative procedure	Risks results	Risks results	Risks results
Kang *et al*.[4] 2011	Gp 1 d/c 100 mg ASA 7 days preop (avg. 9 days) 38 patients Avg. 68.5 years old	Gp 0 No ASA 38 patients Avg. 69.1 years old	Avg. 2-Level Fusion Degenerative Lumbar Disease > Postop drainage Gp 1 vs. Gp 0: 864.4 cc ASA 458.4 cc no ASA	Gp 1 vs. Gp 0=Intraop EBL > TR > Bleeding	Gp 1 vs. Gp 0 > Postop EBL > Drainage
Yang *et al*.[9] 2011	SSEH Acute MI (AMI) 56 year old	Pain; Chest Neck back pain	Meds: Nitroglycerine, ASA, LMWH, Clopidogrel	Pain 3 days later Cervico-thoracic; MR SSEH	Laminectomy: Patient remained plegic 7 mos. later
Gers-tein *et al*.[3] 2012	Risks ASA continued various surgeries	Document CAD Prophy-laxis	Avoid ASA withdrawal Syndrome-Rebound, Hypercoagulation Small risks of bleeding most surgery	Exceptions: Intracranial surgery	Exceptions Intramedullary spine surgery (middle ear, eye and TURP)
Park *et al*.[5] 2013	2004-2009 1-2 Level Lumbar Fusions Gp 0: no ASA 96 controls	86 1-2 Level Fusions Gp 1:d/c ASA preop 3-7 days Gp 2; d/c ASA 7-10 days preop	Significantly>EBL; >Drainage Gp 1 vs. Gp 0 1 level fusions Significantly>Drainage Gp 1 vs. Gp 0 2 Level fusions	Similar Total EBL and Drainage Gp 2 vs. Gp 0 1 level fusions	Gp 1 vs. Gp 0>Total EBL>Drainage Recommend: Stop ASA 7-10 Days=Results Gp 2=Gp 0
Park *et al*.[6] 2014	EBL +/- ASA NSAIDS 2 or > Lumbar Fusions 106 patients-3 Groups	Gp 1- no ASA Gp 2- d/c ASA 1 week preop Gp 3 continued ASA	Continued NSAIDS; comparably and significantly > Bleeding/EBL Gp 3, Gp 2 vs. Gp 1	Gp 1 with NSAIDS sig > EBL vs. No NSAIDS NSAIDS > risk EBL all 3 groups	ASA > bleeding Gp 3 and Gp 2 Even if d/c ASA 1 week preop Gp 2

EBL: Estimated blood loss, LOS, Length of stay, OR: Operative, CAD: Cardiovascular/coronary artery disease, ASA: Aspirin, TR: Transfusion requirement, AE: Adverse events, SS: Spine surgery, ISH: Intraspinal hematomas, SCI: Spinal cord injury, CHP: Chemoprophylaxis, Avg. : Average, CAD: Coronary artery/myocardial disease, F: Female, CAS: Coronary artery stents, SS: Spine surgery, AE: Adverse events, ISH: Intraspinal hematoma, CHP: Chemoprophylaxis, VTE: Venous thromboembolism, PE: Pulmonary embolus, d/c: Stopped, NSAIDS: Anti-inflammatories, Gp: Group, SSEH: Spontaneous spinal epidural hematomas, AMI, Acute myocardial infarction, LMWH, Low molecular weight heparin

Increased blood loss with low-dose aspirin and/or anti-inflammatories (NSAIDS) for patients undergoing spinal surgery

Increased hemorrhagic risks were observed in Park *et al*. (2014) where patients were divided into three groups based on LD-ASA use, and additionally given NSAIDS prior to 2 or more level lumbar fusions [Table 1].[6] Group I patients were on no LD-ASA, Group 2 patients stopped LD-ASA 1 week preoperatively, whereas Group 3 patients continued LD-ASA throuhgout surgery. LD-ASA significantly increased bleeding for Group 3 and Group 2 patients (stopped 7 days preoperatively). Interestingly, additional utilization of NSAIDS in all three groups comparably increased intraoperative, postoperative, and total blood loss. Furthermore, Group 1 patients (on no LD-ASA) but on NSAIDS had significantly greater EBL vs. Group 1 patients on no NSAIDS.

Surgical risk for bleeding on low-dose aspirin increased in cranial/selective spinal surgery

Gerstein *et al*. (2012) determined that continuing LD-ASA to avoid perioperative rebound/hypercoagulation syndrome resulted in only a small increased risk of bleeding for most operations, notably excluding cranial surgery, intramedullary spine surgery, middle ear surgery, eye surgery, and transurethral prostatectomy [Table 1].[5] Given the results from previously quoted studies, these exclusion criteria should probably include other spinal procedures as well.

Case: Acute spontaneous spinal epidural hematoma due to antiplatelet and anticoagulation therapy for acute myocardial infarction

In Yang *et al*. (2010), a 56-year-old male presented with an acute myocardial infarction (AMI) for which he was placed on nitroglycerine, aspirin, low-molecular-weight heparin prophylaxis, and Clopidogrel [Table 1].[9] Three days after the AMI, he developed acute cervicothoracic pain and quadriplegia. When the MR documented a spontaneous cervicothoracic spinal epidural hematoma (SSEH), he underwent emergent surgical decompression. Unfortunately, at 7 postoperative months, he failed to recover. Spontaneous bleeding risks attributed to the simultaneous administration of multiple antiplatelet and anticoagulation therapies should be carefully considered particularly in patients who suddenly develop the new onset of pain complaints and/or new neurological deficits.

Part II: No increased risks for continuing low-dose aspirin (LD-ASA) for spine surgery [Table 2]

Studies support continuation of low-dose aspirin for spine surgery but with instances of acute epidural hematoma/permanent paraplegia

Although several studies supported continuing LD-ASA throughout spine surgery, some series cited significant perioperative morbidity (e.g., permanent paraplegia).[2,7,10] In 2015, Cueller *et al*. studied patients with cardiac disease (CAD) undergoing spine surgery who either continued LD-ASA (100 mg/day) or discontinued LD-ASA (100 mg/day) prior to the surgery [Table 2].[2] Those continuing LD-ASA demonstrated a decreased length of stay and operative time, while showing comparable postoperative EBL, complications, and readmission rates (30 postoperative days). In 2016, Smilowitz *et al*. analyzed patients kept on LD-ASA throughout joint or spine surgery; here, they divided them into early (2008–2009; 3075 patients) and late groups (2013: 2971 patients) [Table 2].[7] The late group showed a reduced risk of perioperative CAD complications, fewer bleeding-related adverse events/significant hemorrhages, and reduced transfusion requirements. When Zhang *et al*. (2017) evaluated 4 SS series performed with/without perioperative LD-ASA, they found continuing LD-ASA did not increase EBL, surgical time, or transfusion requirements [Table 2].[10] However, they found their data were insufficient to determine whether continuing LD-ASA significantly impacted the frequency of perioperative cardiac events, bleeding complications, or LOS.

Postoperative epidural hematoma in patient continuing perioperative ASA

Soleman *et al*. (2016) compared two patient groups undergoing extradural noninstrumented spinal surgery; in 40 patients, LD-ASA was continued, whereas in 62 patients, LD-ASA was stopped prior to the surgery [Table 2].[8] They claimed intraoperative and postoperative blood loss were similar for both groups; however, data for the former were quite disparate, e.g. averaging 221 cc (for the continued LD-ASA group) vs. 140.16 cc for the latter group (stopped LD-ASA). Notably, they concluded there were no significant differences in hematological variables, morbidity, and mortality. Nevertheless, 1 patient remaining on LD-ASA developed an epidural hematoma resulting in irreversible paralysis. How could they, therefore, conclude continuing perioperative LD-ASA for SS was safe and effective?

Mini-heparin and low-dose chemoprophylaxis do not increase size of intraspinal hematoma following spinal cord injury

Following spinal cord injury (SCI), Chang *et al*. (2017) compared the frequency of intraspinal hemorrhage for 241 patients on early chemoprophylaxis vs. 241 patients not placed on early prophylaxis (e.g., mini-heparin, LD-ASA) for deep venous thrombosis ([DVT]/pulmonary embolism [PE]). [Table 2].[1] Although mini-heparin reduced the incidence of DVT/PE, LD-ASA did not. Of interest, neither mini-heparin or LD-ASA contributed to clot expansion in 7% of the patients who originally presented with SCI-related intraspinal hematomas.

Table 2: No increased risks for continuing aspirin with spine surgery

Author [Ref] Year	Patient sample	Operative procedure	Risks results	Risks results	Risks results
Cueller *et al*.[2] 2015	100 Stop ASA 100 Kept ASA Before/After Spine Surgery Cardiac Stents (All CAD)	Continued vs. Stopped ASA<LOS 4.1 vs. 6.2 days<OR Time 210 vs. 266 minutes	Continued vs. Stopped ASA Same EBL 642 vs. 697 cc TR same	Continued vs. Stopped ASA=AE 8% vs. 11% = Readmission 30 Days 5%	No Hematomas Either Group Stopping ASA Not Warranted
Smilowitz *et al*.[7] 2016	Joint (hip knee) + SS Avg. age 61 59% F: 41% M 2008-2009 (Early Study) 3075 patients 4-12/2013 (Late Study) 2971 patients	Continued ASA Late vs. Early<CAD Risks 3.1% vs. 5.8% < Bleeding AE 0.2% vs. 0.8% < TR 17.2% vs. 24.8%	614 with CAD Late vs. Early ASA Continued 66% vs. 30.7% Reduced Risk CAD Injury 13.5% vs. 19.3%	Continued ASA Late vs. Early Hemorrhage Low 0.3% vs. 2.1% Reduced TR 37.2% vs. 44.2%	Risks of Bleeding and CAD Reduced Later Study For those with CAD continuing ASA was Safe
Soleman *et al*.[8] 2016	40 ASA Continued vs. 62 Stopped ASA Preop SS Extradural Non Instrumented SS	Patients with CAD Same EBL Intraop 221 cc vs. 140.16 cc	Same EBL Postop 146.58 cc vs. 167.97 cc	No significant differences TR Hematological variables Morbidity Mortality	1 EDH-patient on ASA preop Reoperation Concluded (?) Continuing ASA safe/ effective
Zhang *et al*.[10] 2017	4 Series Assessed AE for SS with/without ASA	Evaluated: OR Time EBL Bleeding	Evaluated: AE TR LOS	SS with ASA Not > EBL Not > OR Time Not > TR	Insufficient Patients to Assess if continued ASA significantly. impacts CAD AE or LOS
Chang *et al*.[1] 2017	ISH in 501 SCI patients 2012-2015 Chemo-prophylaxis	241 Early CHP Mean Age 43 241 No early CHP Mean Age 49	Early Heparin reduced VTE and PE	Early ASA did not reduce VTE or PE	7 (1%) Expansion ISH NOT related to Early use of heparin or ASA

EBL: Estimated blood loss, LOS: Length of stay, OR: Operative, CAD: Cardiovascular/coronary artery disease, ASA: Aspirin, TR: Transfusion requirement, AE: Adverse events, SS: Spine surgery, ISH: Intraspinal hematomas, SCI: Spinal cord injury, CHP: Chemoprophylaxis, Avg.: Average, CAD: Coronary artery/myocardial disease, F: Female, CAS: Coronary artery stents, SS: Spine surgery, AE: Adverse events, ISH: Intraspinal hematoma, CHP: Chemoprophylaxis, VTE: Venous thromboembolism, PE: Pulmonary embolus, d/c: Stopped, NSAIDS: Anti-inflammatories, Gp: Group, SSEH: Spontaneous spinal epidural hematomas, AMI: Acute myocardial infarction, EDH, Epidural hematoma

CONCLUSIONS

Multiple studies demonstrated the relative increased hemorrhagic risks/complications of performing spinal surgery while continuing LD-ASA or just stopping LD-ASA for 3–7 days prior to SS; notably, several other studies also indicated no such risks if LD-ASA was stopped for >7–10 days [Tables 1 and 2].[1-10] As a spine surgeon who wants to avoid an intraspinal hematoma and irreversible neurological injury, my bias would be to stop ASA at least 7–10 days prior to SS (e.g., more toward day 10). Notably, these studies were of variable quality (e.g., no adequate randomized controlled trials), and came to different conclusions. Finally, each spine surgeon must determine on a case-by-case basis what is in the "best interest" of their patient.

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