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The Impact of Antiplatelet Medication on Hand and Wrist Surgery

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Abstract

Purpose—To quantify the impact of maintaining antiplatelet medication during hand and wrist surgery on bleeding and functional outcomes.

Methods—This prospective cohort trial compared operative outcomes and complications of hand and wrist surgery in patients without interruption of daily antiplatelet medications (n=107 procedures) to control patients (n=107 procedures). Rates of complications requiring reoperation were determined for each group. Measures of surgical site bleeding (extent of ecchymosis, hematoma formation), patient-rated outcome assessment (Quick Disabilities of the Arm, Shoulder, and Hand score, visual analog scales of pain and swelling), and 2-point discrimination were compared between groups. Data were collected preoperatively and postoperatively at 2 and 4 weeks. Control and antiplatelet populations were confirmed to be similar for data analysis according to health status (Short Form-12) and percentage of bony procedures.

Results—One patient on antiplatelet medication required reoperation for surgical site bleeding following wrist arthrodesis (0.9%). There were no complications in the control group. The extent of postoperative ecchymosis was similar in the antiplatelet and control patients at 2 weeks (16mm vs 19mm) and 4 weeks (1mm vs 1mm). Hematoma rates were not increased for patients on antiplatelet medication (17% vs 14% at 2 weeks). Patient-rated function scores were equivalent at baseline and at follow up between groups. Twenty-two control patients and 20 patients on antiplatelet medication had transiently increased 2-point discrimination (2mm change) postoperatively.

Conclusions—Bleeding-related perioperative complications were rare when continuing antiplatelet medications without interruption for hand and wrist surgery. Maintenance of antiplatelet medication does not appear to negatively impact patient-rated or objective measures of function although surgical-site bleeding may be greatest in patients taking higher dose antiplatelet medication and undergoing bony procedures.

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Level of Evidence—II, Prospective Therapeutic**Keywords**

anticoagulation; antiplatelet; hand; surgery; wrist

Introduction

Over 2 million individuals in North America are prescribed antithrombotic medication, and approximately 40 percent of adults over 40 years old in the United States take daily aspirin. [1,2] Antithrombotic medications can be classified into those that effect platelet function (aspirin, clopidogrel, and dipyridamole) and those that alter the function of the coagulation cascade (warfarin [Coumadin], heparin, enoxaparin [Lovenox]). Both aspirin and clopidogrel (Plavix) irreversibly alter platelet function through inhibition of COX-1 and the ADP-receptor, respectively.

Antithrombotic medications are recommended to patients at risk for myocardial infarction, cerebrovascular accident, or pulmonary embolus. Aspirin and clopidogrel are routinely discontinued 7-10 days prior to large joint and abdominal surgery to allow reversal of their effects. In addition to increased risk of thromboembolic events associated with surgery, acute withdrawal of antiplatelet medication leads to a rebound prothrombotic state characterized by increased thromboxane A₂ and decreased fibrinolysis.[3-5] Discontinuation of aspirin therapy prescribed for secondary coronary prevention has resulted in 2-3 fold increases in cardiac complications with thrombotic events occurring at an average of 11 days after medication discontinuation.[6,7] Furthermore, patients are twice as likely to have unintentionally discontinued prescribed antithrombotic treatment 6 months after ambulatory surgery if the medication was held peri-operatively.[8]

This prospective dual cohort study was performed to quantify the impact of performing hand surgery while maintaining patients' antiplatelet medications. Our first hypothesis was that hand and wrist surgery could be performed while maintaining antiplatelet medications with minimal risk of complications requiring reoperation. Our second hypothesis was that non-catastrophic bleeding at the surgical site would be affected by patients' antithrombotic medication (increased extent of ecchymosis) without impacting patient-rated function on a validated outcome measure (Quick Disabilities of the Arm, Shoulder, and Hand [QuickDASH]).

Materials and Methods

This prospective cohort study concurrently enrolled control patients and allowed a comparison of non-catastrophic bleeding (i.e., no reoperation required) and functional outcomes between these controls and patients on antiplatelet medication. This study was approved by our institutional review board, and all patients provided informed written consent. From May, 2009 to August, 2012, all adult patients (≥ 18 years) who underwent surgery about the hand and wrist by 1 of 4 hand fellowship-trained orthopedic surgeons were considered eligible for study inclusion. Inclusion in the antiplatelet cohort required patient self-reported daily intake of an antiplatelet medication (i.e., aspirin, clopidogrel).

These patients were informed that performing surgery while remaining on antiplatelet medication could increase their chance of complications related to surgical site bleeding although we expected chance of bleeding requiring reoperation to be rare based on our prior, anecdotal experience of continuing such medication perioperatively. Discontinuation of such medication could increase a presumably rare chance of thromboembolic event. Patients who reported no use of any antithrombotic medication (antiplatelet or anticoagulant) were eligible to be controls. Criteria for exclusion from both antiplatelet and control groups included the lack of English proficiency, inconsistent use of antiplatelet medication, perioperative discontinuation of an antiplatelet medication, surgery proximal to the distal radius metaphysis, concomitant use of an anticoagulant medication (e.g., warfarin, enoxaparin), and pregnancy. Use of non-steroidal anti-inflammatory drug use was not considered in patient classification or study eligibility for either patient group. Non-steroidal anti-inflammatory drugs may affect coagulation, but we have only encountered patients taking these drugs on an as needed basis for musculoskeletal pain as opposed to taking them for cardiovascular protection. In this setting patients were often unable to accurately report dosages consumed.

A total of 107 procedures were performed on 92 patients maintained on perioperative antiplatelet medications. This cohort consisted of 44 males (48%) with an average age of 64 (SD± 10) years. The antiplatelet medications prescribed included: aspirin (n=76), clopidogrel (n=5), and combination aspirin and clopidogrel (n=11). Of the patients on isolated daily aspirin therapy, 60 were taking 81mg daily, and 16 were taking more than 81 mg. The dose of clopidogrel was 75mg daily for all treated patients. In patients taking both aspirin and clopidogrel, aspirin dose was 81 mg in 4 and more than 81 mg in 7 patients. Indications for such antiplatelet medication are detailed in Table 1. Sixteen patients had coronary stents in place. A concurrently collected control cohort consisted of data from 107 procedures performed on 94 patients not prescribed antiplatelet or anticoagulant medication. All controls confirmed verbally that they were not using any aspirin.

No perioperative changes were made to the patient's current antiplatelet therapy regimen. Each surgery was performed under tourniquet control with deflation timing (i.e., deflation prior to or following, skin closure and dressing application) per standard practice of the treating surgeon. All local infiltrative anesthetics used for postoperative pain control were free of epinephrine. Surgical procedures were categorized as soft tissue or bone procedures (Table 2). Per standard care, surgical patients received a phone call the day after surgery by operating room personnel to confirm patients' comfort and inquire about concerns.

Data Collection

Study data were collected at baseline (pre-operative visit) and at 2 and 4 weeks postoperatively. Certified hand therapists, blinded to the patients' cohort assignment conducted all study-related physical examination measurements and collected patient-rated measures to minimize bias associated with surgeon data collection. Data collection was identical for patients on antiplatelet medication and controls.

Complication rates were quantified for all procedures on patients in the antiplatelet group. Complications included hematoma or surgical site bleeding, surgical site infection, or wound

dehiscence requiring reoperation. These complications were chosen as they could be reasonably attributed to greater surgical site bleeding. We quantified only those complications requiring reoperation as these were felt to represent clinically relevant wound complications imparting clear morbidity to the patient.

Pre and postoperative measurements included static 2-point discrimination. Measurements exclusive to the postoperative visits included determination of hematoma (present/absent) and greatest extent of contiguous ecchymosis from the surgical incision (mm). To minimize the chance of underestimating local bleeding, hematoma was defined to include any swelling with palpable fluid collection regardless of size.

All patient-rated measures were completed in writing by the patient while in the surgeon's office. The Short Form 12 (SF-12) was completed at baseline, and the QuickDASH was completed by each patient both pre- and postoperatively. The SF-12 is a validated measure of general health and was collected to compare overall health and the burden of comorbid disease between those on antiplatelet medications and controls. The QuickDASH is a validated measure of upper extremity disability, intended to assess the degree of functional disability before and after surgery. At each postoperative visit, patients also complete visual analog scales (VAS) specific to hand pain and swelling.

Statistical Analysis

Complication rates were quantified for each patient group. The relative risk for complication in each group was calculated with 95% confidence intervals.

Descriptive statistics were produced to characterize each cohort's demographics. The control population selected for analysis was confirmed equivalent with the antiplatelet group by general health (pre-operative SF-12) and percentage of procedures involving bone. Postoperative examination findings (hematoma rates, ecchymosis extent, 2-point discrimination sensibility), and patient-rated outcomes (QuickDASH, VAS scores) were compared between procedures on patients consuming antiplatelet medications and on control patients. Continuous outcome measures were compared using Student t test, and categorical measures were compared with chi square analysis.

Subgroup analysis examined outcomes between those patients on low dose aspirin (81mg daily) versus high dose antiplatelet therapy (>81mg daily or clopidogrel). Summary statistics were also produced comparing patients on antiplatelet medication undergoing bony versus soft tissue procedures. Statistical significance testing was not performed on subgroup analysis secondary to limited power.

As complications requiring reoperation were expected to be a rare event, this study was powered to produce a sufficiently precise estimate of the true complication rate. An a-priori power analysis established the need for at least 43 patients in the antiplatelet group to produce precise 95% confidence intervals (3% precision) assuming a rare (1%) complication rate (reoperation, wound dehiscence, infection) requiring reoperation. To calculate sample size requirements to complete comparative data between antiplatelet and control patients we examined pilot data (first 40 control patients). We calculated that 50 patients per group

analyzed would provide power with $\beta = 0.90$ and $\alpha < 0.05$ to detect a conservative estimate of the minimally clinically important difference in patient-rated function on the QuickDASH (10 points, SD 12), a 2-point change in VAS scales, and a 10mm difference in extent of ecchymosis.[9-11] This degree of change in ecchymosis was chosen ad-hoc for this investigation according to consensus by 4 attending investigators.

Results

Complications

No surgical complications occurred in the control group (0%, 95% CI 0.0-3.4%). Among patients on antiplatelet medication, there were no wound infections or dehiscence (0%, 95% CI 0.0-3.4%). One patient on antiplatelet medication required reoperation for surgical site bleeding (complication rate 0.9%, 95% CI 0.02-5.1%). This elderly female with rheumatoid arthritis was taking high dose daily aspirin (325 mg, 2-8 tablets per day). She underwent a wrist arthrodesis and ulnar shortening via a standard dorsal approach with extensive dorsal teno-synovectomy. A tourniquet was used and deflated prior to skin closure to obtain hemostasis. On the next day the patient developed increased pain, swelling, and paresthesia in her median nerve distribution. She required emergent hematoma evacuation and carpal tunnel release. Two point discrimination returned to normal 25 weeks later.

No patient on antiplatelet medication experienced any perioperative cardiovascular or other thromboembolic event during this study.

Antiplatelet vs Control Comparison

The antiplatelet and control groups were similar at baseline except that the antiplatelet cohort was older by a mean of 11 years and was more predominately male (Table 3). The timing of tourniquet deflation was more often prior to dressing application in the antiplatelet patient procedures 54 (51%) as opposed to control cases 38 (36%) ($P=0.03$).

The rate of hematoma formation was similar for patients on antiplatelet medication and controls at 2 weeks (17% vs 14%, $p = 0.6$) and 4 weeks (3% vs 3%, $P>0.9$). Measurement of postoperative ecchymosis was similar in the antiplatelet and control patients at 2 weeks (16mm vs 19mm, $P=0.5$) and 4 weeks (1mm vs 1mm). Transient increased 2-point discrimination (≥ 2 mm in at least a single digit) was present in 22 control and 20 antiplatelet patients postoperatively. For each group, those patients with increased 2-point discrimination had undergone both bone and soft tissue procedures (control: 6 bone vs 16 soft tissue) (antiplatelet: 3 bone vs 17 soft tissue).

The control and antiplatelet patients reported similar postoperative pain (2 week, $P=0.53$; 4 week, $P=0.18$) and swelling (2 week, $P=0.14$; 4 week, $P=0.31$) (Figure 1). QuickDASH scores remained similar between the patient groups at 2 ($P=0.95$) and 4 weeks ($P=0.95$) postoperatively (Figure 2).

Antiplatelet Subgroups

Outcome measures were compared between those patients taking one 81mg aspirin daily and those consuming higher dose aspirin and clopidogrel. Details of this comparative data

are presented in Table 4. At each follow up, all groups demonstrated similar patient-rated function and VAS ratings. Patients on high dose aspirin and clopidogrel demonstrated more frequent hematoma occurrence at 2 weeks than did the low dose aspirin patients (22-31% versus 12%). The extent of contiguous ecchymosis tended to be greater in the patients on high dose aspirin and clopidogrel compared to low dose aspirin patients.

When examining bony procedures (n=20) versus soft tissue procedures (n=87), there was a clinically relevant increase in the extent of ecchymosis at 2 weeks (45mm vs 9mm) and rate of hematoma formation (33% vs 12%). All outcome measures were similar though between the 2 groups by 4 weeks.

Discussion

There is no consensus as to the perioperative management of antiplatelet medication for hand surgery. However, interruption of antiplatelet medication is associated with potentially lethal or critically morbid complications, causally related to the prothrombotic period following medication interruption. In a case-control study of patients taking daily low dose aspirin, an increased risk of myocardial infarction was noted in patients who discontinued aspirin therapy.[12] The risk associated with stopping antiplatelet treatment appears well within a normal perioperative window with 1 study reporting a 3-fold increased occurrence of myocardial infarction an average of 10 days after acute withdrawal of aspirin.[13] Furthermore, the mortality associated with acute coronary syndrome has been shown to be increased in patients who have recently discontinued aspirin therapy whether used for primary or secondary prevention.[14] In 2 studies of ischemic stroke, nearly 5% were associated with recent withdrawal of antithrombotic medication.[9,15] This rate was significantly increased over similar patients without interruption of antithrombotic therapy. [15] Physician-directed discontinuation during the perioperative period was the reason for medication withdrawal in nearly 50% of patients.[15] Therefore, we chose to conduct this prospective cohort investigation while maintaining our group's established clinical practice of continuing prescribed antiplatelet therapies.

Our results are similar to those of Edmunds and Avakian who reported on 64 operations in patients undergoing hand surgery (and one cubital tunnel surgery) while continuing prescribed clopidogrel.[16] In that series, 24 patients were taking both clopidogrel and aspirin. A single major complication of hematoma requiring surgical evacuation occurred in a patient with rheumatoid arthritis following ulnar head excision with synovectomy and extensor tendon transfers. Without further quantification, additional complications included, "Excessive intra-operative bleeding(n=6), excessive bruising(n=1), wound infection(n=1), dusky skin graft(n=1), postoperative bleeding(n=1)." Our data expand upon their work by quantifying ecchymosis and adding a control group for comparison with patients undergoing similar surgery without prescribed antiplatelet medication. In both our series and Edmunds's, the 1 major complication occurred in a patient with rheumatoid arthritis following a bony procedures. Our current study is not sufficient to make a definitive statement regarding risk in this specific population but we believe this suggests that caution is warranted in this demographic.

The impact of perioperative antiplatelet medication has been investigated outside of hand surgery. A prospective study of peripheral artery surgery reported no difference in reoperation or postoperative hematoma formation between those patients on antiplatelet regimens, including aspirin or combined aspirin and clopidogrel, and controls taking no antiplatelet agents.[17] A similar result has been seen in patients who underwent dental surgery, ocular surgery, and endoscopy.[18-20] Within orthopedics, aspirin use has not been found to negatively impact mortality or major complications during total hip arthroplasty, femoral neck surgery, or spine surgery despite some evidence of greater local bleeding. [21-24] Our data suggest that hand and wrist surgery, which involves minimal dissection through muscle, largely falls into a low-risk surgical category amenable to continuation of antiplatelet therapy.

The 107 procedures in our study population performed while the patient was on aspirin and/or clopidogrel resulted in neither wound infection nor dehiscence, and only 1 bleeding complication requiring reoperation. This case was reported as an adverse event to our institutional review board. Postoperatively, it became apparent that this patient's situation was unique in that she admitted to taking additional aspirin for pain relief such that she could consume up to 8 times the standard dose recommended for prevention of thromboembolic events and therefore may not be representative of the general population taking antiplatelet medication. Despite this, we felt that she could not be excluded from our series post-hoc as this complication was likely related to use of an antiplatelet medication even though wrist arthrodesis can be complicated by postoperative carpal tunnel compression in patients not taking antiplatelet medication.[25]

Several limitations are inherent in our study. This is a prospective case-control study rather than a randomized control trial and therefore assumes a risk for bias associated with inequalities between cases and controls. The fact that antiplatelet patients were older may have biased us toward finding more ecchymosis and hematoma in the antiplatelet group given age-related changes in the soft tissues. However, the use of aspirin in the antiplatelet group may have provided pain relief or decreased swelling secondary to its antiinflammatory properties. Additionally, all procedures were performed under tourniquet control, but deflation of the tourniquet before of after wound closure and dressing application was determined by the treating surgeon. In our practice, participating surgeons held strong but opposing beliefs regarding best practice to limit postoperative surgical bleeding (i.e., tourniquet deflation and selective cauterization versus tamponade effect of a compressive dressing). Therefore, we were unable to control for this factor. It was more common in this series for the tourniquet to have been deflated prior to dressing application to confirm hemostasis. It is possible that this may have impacted the rate of bleeding complication. Our findings suggest that both higher dose antiplatelet medication and bony surgical procedures lead to increased local bleeding without negative impact on functional outcomes; however, our subgroups were too small to conduct statistical significance testing, so we reported findings that we believed to be clinically relevant. Estimation of bleeding risk specific to bony procedures and antiplatelet medication dosage will require continued study. Although we do not have reason to expect substantial differences in risk of complications, our series did not include any arthroscopic procedures or endoscopic carpal tunnel releases.

When determining the best approach to perioperative management of established antiplatelet medication, the specific risks and benefits for each patient should be considered. Patients, as in this series, take antiplatelet for both primary and secondary prevention of thrombotic or embolic events. Patients with prior cardiac or cerebrovascular events would be presumed to be at greatest systemic risk when discontinuing antiplatelet medications. However, even patients taking such medication chronically for family history or multiple individual risk factors for thromboembolic events (i.e., primary prevention) are noted to have reduced rates of all-cause mortality, myocardial infarction, and ischemic stroke while taking aspirin and experience heightened risk of acute coronary events and 30 day mortality when interrupting such therapy.[14,26] Thus, surgeons must decide if the risk of bleeding complication requiring reoperation associated with continuing antiplatelet medication is acceptable on a case-by-case basis.

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Figure 1.
Comparison of VAS scores between antiplatelet group and controls.

Figure 2.
Comparison of QuickDASH scores between antiplatelet group and controls.

Table 1

Indications for antiplatelet therapy.

Indication for Antiplatelet Therapy	Antiplatelet Therapy		
	Low Dose Aspirin (81mg/d) (N=60)	High Dose Aspirin (>81 mg/d) (N = 16)	Clopidogrel ± Aspirin (N = 16)
Primary prevention: Coronary *	42	9	1
Secondary prevention: Coronary	11	5	10
Secondary prevention: Cerebrovascular	2	0	2
Secondary prevention: Combined coronary artery and cerebrovascular disease	1	1	1
Prior DVT/PE ⁺	3	0	1
Atrial Fibrillation	0	1	0
Prothrombotic disease	1	0	1
Pain Relief	0	1 ^{**}	0

* Primary prevention: antiplatelet medication prescribed to patients at increased risk of coronary disease based on family history or personal risk factors without sentinel event.

** Patient already included in "Primary Prevention:Coronary" but was only patient also taking additional aspirin for pain relief.

⁺ Deep vein thrombosis/pulmonary embolus

Table 2

Hand surgical procedures performed in controls and patients on antiplatelet therapy.

	Control patients	Antiplatelet patients
Soft Tissue	Total procedures: 82	Total procedures: 87
Open carpal tunnel release	39	48
Trigger finger release	23	21
Excision soft tissue mass or ganglion	10	13
Other	10	5
Bone Involvement	Total procedures: 25	Total procedures: 20
Open reduction and internal fixation distal radius fracture	6	3
Thumb carpal-metacarpal arthrodesis or interpositional arthroplasty with trapezium excision	7	6
Wrist or carpal arthrodesis	4	4
Other	8	7

Table 3

Baseline comparison of antiplatelet and control cohorts.*

	Antiplatelet	Controls	P value
% Male	0.48	0.34	0.06
BMI	32 ± 7	31 ± 8	0.35
Age	64 ± 10	53 ± 10	<0.01
SF-12			
Physical Score	41 ± 11	42 ± 10	0.52
Mental Score	53 ± 9	54 ± 8	0.47
Quick DASH	41 ± 25	40 ± 24	0.93

* Values mean ±SD

Table 4

Outcome measures across antiplatelet subgroups.*

	Low Dose Aspirin (n=69)	High Dose Aspirin (n=20)	Plavix (n=18)
% Male	44%	60%	56%
BMI	30 ±10	32	34
Age	64 ±10	64	65
Baseline Quick DASH	39 ± 25	39 ± 19	50 ± 29
Bony Procedure %	17%	30%	11%
2 week			
Hematoma	12%	22%	31%
Ecchymosis	12 ±25	28 ± 56	17± 21
VAS pain	2.3 ±2.1	2.8 ±1.7	2.9± 2.6
VAS swelling	2.3 ±2.1	3.2 ±2.7	2.9± 2.8
Quick DASH	44 ±24	39±16	49± 25
4 week			
Hematoma	2.5%	5.6%	0
Ecchymosis	2 ±10	1 ± 3	0
VAS pain	1.9 ±2.2	2.9 ±2.4	1.8 ±2.4
VAS swelling	2.1 ±2.4	2.0 ±1.6	1.6 ±1.9
Quick DASH	26 ±22	28 ±15	32 ±21

* Values mean ±SD