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Original Article

Direct Oral Anticoagulant Use Early After Cardiac Surgery: A Retrospective Cohort Study

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ABSTRACT

Background: There is limited literature guiding the prescribing of direct oral anticoagulants (DOACs) early after cardiac surgery as this population has been excluded from landmark randomized controlled trials. This study aims to determine the rate of in-hospital DOAC use compared with warfarin early after cardiac surgery, evaluate factors associated with DOAC use, determine difference in postoperative length of stay, and characterize bleeding events.

Methods: A retrospective cohort study was conducted in adult patients with indications for anticoagulation and receiving either a DOAC or warfarin after cardiac surgery during their index hospitalization. Patients were excluded if they had any contraindications to DOAC use.

RÉSUMÉ

Introduction : Il existe peu de documentation sur la prescription des anticoagulants oraux directs (AOC) peu de temps après la chirurgie cardiaque puisque cette population a été exclue des essais cliniques novateurs à répartition aléatoire. La présente étude vise à déterminer le taux d'utilisation des AOC à l'hôpital par rapport au taux d'utilisation de la warfarine peu de temps après la chirurgie cardiaque, à évaluer les facteurs associés à l'utilisation des AOC, à déterminer l'écart de la durée du séjour et à caractériser les événements hémorragiques.

Méthodes : Nous avons réalisé une étude de cohorte rétrospective auprès de patients adultes qui avaient des indications d'anticoagulation et qui recevaient des AOC ou de la warfarine après la

Direct oral anticoagulants (DOACs) have largely replaced warfarin as the preferred oral anticoagulant for various thromboembolic conditions. Current guidelines from the Canadian Cardiovascular Society and the American Heart Association/American College of Cardiology/Heart Rhythm Society recommend using DOACs over warfarin as first-line therapy in atrial fibrillation (AF) because large randomized controlled trials (RCTs) have demonstrated noninferior or superior efficacy and similar or superior safety profiles.[1,2] Although AF (pre-existing or postoperative) is the most common indication for anticoagulation after cardiac surgery, the aforementioned RCTs supporting DOAC use over warfarin in AF excluded cardiac surgery patients.[3-6] Initial trials of DOACs in cardiac surgery for mechanical valves did not demonstrate favourable outcomes, and studies of less than therapeutic doses also did not demonstrate superiority for graft protection after coronary artery bypass grafting (CABG).[7,8] Various systematic reviews of DOAC safety and efficacy early after cardiac surgery found primarily retrospective observational studies that used heterogeneous definitions for bleeding outcomes were not powered to detect clinically important differences.[9-11] The only RCT found conducted to date on DOACs early after cardiac surgery was limited to 56 participants and was not powered to detect a difference in bleeding events or stroke.[12]

Mechanistically, cardiac surgery patients are at increased risk of bleeding caused by platelet dysfunction, hemodilution, increased fibrinolysis, hypothermia from exposure to cardiopulmonary bypass, high-dose intravenous unfractionated heparin use, and manipulation of the pericardium.[13,14] Clinically, one of the most relevant bleeding complications

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The primary outcome was the proportion of patients discharged on a DOAC compared with warfarin.

Results: Of included 210 patients, 30% received DOACs and 70% received warfarin on discharge. The most common DOAC used was apixaban (74.6%), and median postoperative day of initiation was 5 days. Patients receiving DOACs were older (70.8 vs 68.0 years), had less valvular heart disease (38.1% vs 63.9%), were more likely to be on DOACs preoperatively (50.8% vs 31.3%), and were more likely to have undergone coronary artery bypass graft alone (54.0% vs 24.5%) compared with those on warfarin. Postoperative length of stay (7 vs 9 days; $P = 0.59$) and in-hospital bleeding (1.6% vs 2.0%; $P = 1.00$) did not differ between DOAC and warfarin groups.

Conclusions: At a quaternary referral centre for cardiac surgery, DOACs were used in approximately one-third of patients with an indication for anticoagulation early after cardiac surgery.

chirurgie cardiaque durant l'hospitalisation de référence. Les patients étaient exclus s'ils avaient des contre-indications à l'utilisation des AOC. Le critère d'évaluation principal était la proportion de patients sortis de l'hôpital sous AOC par rapport à celle des patients sortis de l'hôpital sous warfarine.

Résultats : Parmi les 210 patients inclus, 30 % ont reçu des AOC et 70 % ont reçu de la warfarine à la sortie de l'hôpital. L'AOC le plus fréquemment utilisé était l'apixaban (74,6 %), et le nombre médian de jours après l'intervention chirurgicale du début du traitement était 5 jours. Les patients qui recevaient les AOC étaient plus âgés (70,8 *vs* 68,0 ans), avaient moins de cardiopathies valvulaires (38,1 % *vs* 63,9 %), étaient plus susceptibles de recevoir des AOC avant l'opération (50,8 % *vs* 31,3 %) et étaient plus susceptibles d'avoir seulement subi un pontage aorto-coronarien (54,0 % *vs* 24,5 %) que ceux sous warfarine. La durée du séjour postopératoire (7 *vs* 9 jours ; $P = 0,59$) et les événements hémorragiques à l'hôpital (1,6 % *vs* 2,0 % ; $P = 1,00$) ne différaient pas entre les groupes qui recevaient les AOC et les groupes qui recevaient la warfarine.

Conclusions : Dans un centre d'aiguillage de soins quaternaires en chirurgie cardiaque, les AOC ont été utilisés chez environ un tiers des patients qui avaient une indication d'anticoagulation peu de temps après la chirurgie cardiaque.

postcardiac surgery is pericardial effusion progressing to cardiac tamponade, which may be a major reason for hesitancy among clinicians to use DOACs in this population.[15] Previous studies of postoperative use of anticoagulants (primarily using warfarin and heparin) have demonstrated associated increased risk of large pericardial effusions with anticoagulation, and it is currently unclear if this same increased risk can be extrapolated to DOACs and how they may compare with warfarin.[16] A recent systematic review and meta-analysis on anticoagulant use in patients with postoperative AF found a reduced risk of arterial thromboembolism and an increased risk of bleeding but did not differentiate between use of warfarin and DOACs.[17]

Despite the lack of evidence and potential bleeding risks, DOAC use in this population has tripled in the United States in recent years.[18] Moreover, a 2016 survey of European countries found that 75% of centres used DOACs after cardiac surgery in at least some patients.[19] There is considerable variability with regard to DOAC prescribing practices, and there is currently no published literature on the prevalence of DOAC use early after cardiac surgery in Canadian centres. Hence, the objective of this study was to characterize the use of DOACs compared with warfarin early after cardiac surgery at a Canadian quaternary cardiac surgery referral centre.

Methods

We conducted a single-centre retrospective cohort study of all patients admitted to the cardiac surgery unit between January 1, 2020 and August 31, 2021. This time course was selected for convenience and designed to gather baseline data for a subsequent pilot RCT.[20] A list of patients who received DOACs (apixaban, dabigatran, edoxaban, rivaroxban) or warfarin during the index hospitalization after cardiac surgery was generated using the hospital pharmacy information management system. We included adults ($\geq$ 18 years) who underwent cardiac surgery and received oral anticoagulants during their index hospitalizations for any indications other than those listed in the exclusion criteria. We excluded patients with mechanical heart valves, moderate-to-severe mitral valve stenosis, end-stage liver disease (cirrhosis or bilirubin greater than 2 times the upper limit of normal with liver enzymes $>$ 3 times the upper limit of normal), end-stage renal disease, or concurrent therapy with a strong cytochrome P450 3A4 /P-glycoprotein inhibitor or inducer (ketoconazole, itraconazole, voriconazole, posaconazole, ritonavir, rifampin, phenytoin, carbamazepine, or phenobarbital).

Exposures

We classified patients as being in the DOAC group (apixaban, dabigatran, edoxaban, or rivaroxaban) or warfarin group based on the oral anticoagulant prescribed at discharge from their index hospitalizations.

Outcomes

The primary outcome was the proportion of patients discharged on DOAC compared with warfarin during the index hospitalization after cardiac surgery. Secondary outcomes included the difference in factors associated with DOAC use compared with warfarin use; difference in postoperative length of stay (in days) in those on DOAC compared with warfarin; and the difference in the rate, type, and timing of bleeding events in those on DOAC compared with warfarin.

Data collection

One researcher (J.J.W.) extracted the data into an Excel spreadsheet, with a second researcher (J.J.) auditing data for 10% of participants. The following baseline characteristics were collected: demographics (age, sex, weight, body mass index, and whether the patient was from the local health authority), past medical history (any history of cerebrovascular

accident, AF, coronary heart disease, valvular heart disease, hypertension, heart failure, chronic kidney disease, bleeding history, diabetes, cancer), HAS-BLED (**H**ypertension, **A**bnormal Renal/Liver Function, **S**troke, **B**leeding History or Predisposition, **L**abile INR, **E**lderly [>65 Years], **D**rugs/Alcohol Concomitantly) score, $CHAD_2S_2$-VASc (**C**ongestive Heart Failure, **H**ypertension, **A**ge [≥ 75 Years] [doubled], **D**iabetes Mellitus, **S**troke [doubled], **V**ascular Disease, **A**ge [65-74] Years, **S**ex **C**ategory [Female]) score, antithrombotic use before admission, renal function on admission, surgeon, type of surgery, urgency of surgery, aorta cross clamp time, and cardiopulmonary bypass time. Occurrence of postoperative atrial fibrillation (POAF), use of deep vein thrombosis (DVT) prophylaxis, use of bridging, anticoagulant agent and dose, time of initiation (in days after operation), indication for anticoagulation, and estimated glomerular filtration rate (eGFR) on the day of initiation were collected. On the day of discharge, discharge medications, international normalized ratio (INR), hemoglobin, and bridging requirements were also collected.

Statistical analysis

We used means and medians to describe normally distributed and non-normally distributed continuous variables, respectively, and proportions (%) to describe dichotomous variables. We compared normally distributed continuous variables between the DOAC group and warfarin group using a 2-tailed Student's *t*-test, non-normally distributed variables using the Wilcoxon rank sum test, and dichotomous variables using Fisher's exact test. Differences in factors associated with DOAC use compared with warfarin use were investigated to characterize DOAC prescribing. We assessed temporal trends in DOAC use by evaluating the proportion of study participants receiving a DOAC in each quarter of the study period. We performed all analyses in Excel (Microsoft, Redmond, California, USA) and GraphPad QuickCalcs (GraphPad Software, San Diego, California, USA). Testing for statistical significance was based on a 2-sided significance level of 0.05.

Results

From 556 patients screened, we included 210 patients in our analysis (Fig. 1). At the time of surgery, the mean age was 69 years; 28% were female; 50% (n = 104) had indications for anticoagulation, with the most common being pre-existing AF (94%, 98 of 104). Of those on anticoagulation before admission (46%), the majority of patients were on DOACs compared with warfarin (81% vs 19%); the mean HAS-BLED and CHA_2DS_2-VASc scores were 1.6 and 3.1, respectively (Table 1).

With regard to the primary outcome, 63 patients (30%) received DOACs, and 147 (70.0%) received warfarin on discharge (Fig. 1); this proportion was consistent throughout the study period. The most common indications for anticoagulation in the DOAC and warfarin groups included preoperative AF (50.8% vs 44.9%; $P = 0.4537$) and postoperative AF (38.1% vs 32.0%; $P = 0.4277$) (Table 2). Of the patients whose only indication for anticoagulation was valve surgery (n = 29), all received warfarin. Of the patients on a DOAC (n = 63), most received apixaban (n = 47, 74.6%) with

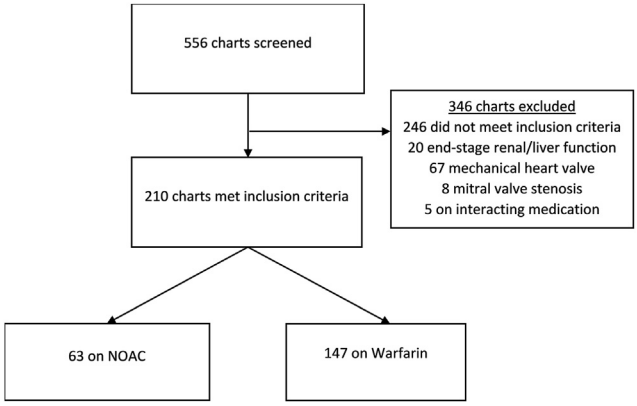

Figure 1. Patient flow chart.

majority on 5 mg twice daily (n = 31, 66%), and the remaining received rivaroxaban 20 mg daily (n = 16, 25.4%) (Fig. 2). Of all the patients who were on DOACs after cardiac surgery, 74.6% were appropriately dosed. Of those who were inappropriately dosed (n = 16), all were underdosed (eg. received apixaban 2.5 mg twice daily for AF when meeting 1 or fewer of the criteria for reduced dosing). Of all patients who were discharged on warfarin (n = 147), the median INR on discharge was 2 (interquartile range [IQR]: 1.8-2.3); 45.6% had INRs < 2.0, 51.0% had INRs 2.0-3.0, and 3.4% had INRs > 3.0. Median postoperative day of initiation was 5 days (IQR: 4-7) for DOAC, compared with 1 day (IQR: 1-4) for warfarin ($P < 0.0001$). Bridging was used in only 5% (n = 3) patients in the DOAC group compared with 17% (n = 25) in the warfarin group, with the majority (100% DOAC, 96% warfarin) receiving low target heparin infusion (target partial thrombosis time [PTT]: 50-70 seconds); only 1 patient in the warfarin group received standard target heparin infusion (target PTT: 60-90 seconds). Most patients received concomitant aspirin on discharge (DOAC 85.7% and warfarin 83.7%). Although most anticoagulated patients were on DOACs (81 %) preoperatively, postoperatively, the majority of preoperative DOAC users (59%, 46 of 78) were switched to warfarin (ie, 41% of preoperative DOAC users had their DOACs continued on discharge).

With regard to factors associated with DOAC use, we found that those with older age ($P = 0.03$), absence of valvular heart disease ($P = 0.0008$), DOAC use before admission ($P = 0.008$), receiving CABG only ($P < 0.0001$), and individual surgeons were associated with DOAC use (Table 2**).** A greater proportion of patients in the DOAC group underwent CABG only compared with the warfarin group (54.0% vs 24.5%; $P < 0.0001$), whereas a higher proportion of patients in the warfarin group underwent valvular surgery only, mitral valve replacement (29.3% vs 4.8%; $P < 0.0001$), and mitral valve/tricuspid valve repair (40.8% vs 7.9%; $P < 0.0001$) compared with the DOAC group (49.0% vs 23.8%; $P = 0.0007$).

Only 1 patient had a bleeding event in the DOAC group (1.6%) compared with 3 patients with bleeding (2.0%) in the warfarin group ($P = 1.00$; see Table 3 for details on event timing and clinical course). No patients who experienced bleeding events were on bridging at the time of the bleed.

Table 1. Baseline characteristics

	Total (n = 210)	DOACs (n = 63)	Warfarin (n = 147)	*P* value
Demographics				
Age, years ± SD	68.9 ± 10.3	70.8 ± 9.07	68.0 ± 10.7	0.0273
Male sex, n (%)	152 (72.4)	48 (76.2)	104 (70.7)	0.5015
Medical history				
AF, n (%)	99 (47.1)	32 (50.8)	67 (45.6)	0.5471
Valvular heart disease, n (%)	118 (56.2)	24 (38.1)	94 (63.9)	0.0008
Aortic stenosis, n (%)	43 (20.5)	14 (22.2)	29 (19.7)	0.7108
Mitral regurgitation, n (%)	57 (27.1)	6 (9.5)	51 (34.7)	< 0.0001
Tricuspid regurgitation, n (%)	33 (15.7)	6 (9.5)	27 (18.4)	0.1468
Aortic regurgitation, n (%)	11 (5.2)	2 (3.2)	9 (6.1)	0.5113
Other, n (%)	2 (1.0)	0 (0)	2 (1.4)	1.0000
Previous cardiac surgery, n (%)	19 (9.0)	3 (4.8)	16 (10.9)	0.1955
Abnormal liver function, n (%)	5 (2.4)	2 (3.2)	3 (2.0)	0.6374
Chronic kidney disease, n (%)	53 (25.2)	20 (31.7)	33 (22.4)	0.1682
History of bleeding, n (%)	7 (3.3)	3 (4.8)	4 (2.7)	0.4306
HAS-BLED, mean ± SD (median)	1.6 ± 1.0 (2)	1.4 ± 1.0 (1)	1.6 ± 1.0 (2)	0.5958
CHA_2DS_2-VASc, mean ± SD (median)	3.1 ± 1.5 (3)	3.2 ± 1.4 (3)	3.0 ± 1.5 (3)	0.3594
Medications before admission				
Anticoagulant, n (%)	96 (45.7)	34 (54.0)	62 (42.2)	0.1319
DOAC	78 (37.1)	32 (50.8)	46 (31.3)	0.0084
Warfarin	18 (8.6)	2 (3.2)	16 (10.9)	0.1036
Antiplatelet, n (%)	71 (33.8)	20 (31.7)	51 (34.7)	0.7512

AF, atrial fibrillation; CHA_2DS_2-VASc, **C**ongestive Heart Failure, **H**ypertension, **A**ge (≥ 75 Years) (doubled), **D**iabetes Mellitus, **S**troke (doubled), **V**ascular Disease, **A**ge (65-74) Years, **S**ex **C**ategory (Female); DOAC, direct oral anticoagulant; HAS-BLED, **H**ypertension, **A**bnormal Renal/Liver Function, **S**troke, **B**leeding History or Predisposition, **L**abile INR, **E**lderly [> 65 Years], **D**rugs/Alcohol Concomitantly; SD, standard deviation.

Overall, there was no difference in median postoperative length of stay between the DOAC group (7 days, IQR: 6-10) and warfarin group (9 days, IQR: 6-11); $P = 0.59$.

Discussion

This is the first study on the rate of DOAC use early after cardiac surgery at a quaternary referral cardiac surgery centre in Canada. This retrospective cohort study showed that 30% of patients received DOACs started on postoperative day 5 (range: 4-7), with most also concomitantly on aspirin. Univariate analysis showed that older age, absence of valvular heart disease, use of DOACs before admission, surgeon preference, and CABG surgery were all associated with DOAC use postoperatively. There was no difference between the 2 groups in terms of HAS-BLED score, history of bleeding, history of chronic kidney disease, or renal function on the day of initiation. There was also no difference in in-hospital bleeding rates, and no stroke events occurred post-operatively before initiation of anticoagulation.

Comparing the results with data from the United States, the proportion of patients receiving DOACs after cardiac surgery is similar to the rates reported by Beller et al. (35.4%).[18] The use of DOACs early after cardiac surgery was stable throughout the duration of this study and did not increase over time. That being said, the time range only extends as far back as 2019, whereas the study by Beller et al. investigated DOAC use for a longer period of time (ie, between 2011 and 2018). This could be a reflection of the change in guidelines that occurred before 2019 recommending DOACs

Table 2. Secondary outcomes

	Total (n = 210)	DOACs (n = 63)	Warfarin (n = 147)	*P* value
Surgical procedure				
CABG only, n (%)	70 (33.3)	34 (54.0)	36 (24.5)	< 0.0001
Valvular surgery only, n (%)	87 (41.4)	15 (23.8)	72 (49.0)	0.0007
CABG + valvular surgery, n (%)	43 (20.5)	11 (17.5)	32 (21.8)	0.5770
Other, n (%)	44 (21.0)	8 (12.7)	36 (24.5)	0.0646
Any valvular surgery	130 (61.9)	26 (41.3)	104 (70.7)	< 0.0001
MVR, n (%)	46 (21.9)	3 (4.8)	43 (29.3)	< 0.0001
AVR, n (%)	57 (27.1)	18 (28.6)	39 (26.5)	0.8657
MV or TV repair, n (%)	65 (31.0)	5 (7.9)	60 (40.8)	< 0.0001
Other, n (%)	8 (3.8)	2 (3.2)	6 (4.1)	1.0000
AF ablation, n (%)	15 (7.1)	1 (1.6)	14 (9.5)	0.0428
Indication for anticoagulation				
Preoperative AF, n (%)	98 (46.7)	32 (50.8)	66 (44.9)	0.4537
Postoperative AF, n (%)	71 (33.8)	24 (38.1)	47 (32.0)	0.4277
Valvular surgery only, n (%)	29 (13.8)	0	29 (19.7)	< 0.0001
Other, n (%)	12 (5.7)	7 (11.1)	5 (3.4)	0.0462

AF, atrial fibrillation; AV, atrial valve; AVR, atrial valve replacement; CABG, coronary artery bypass graft; DOAC, direct oral anticoagulant, MV, mitral valve; MVR, MV replacement; SD, standard deviation.

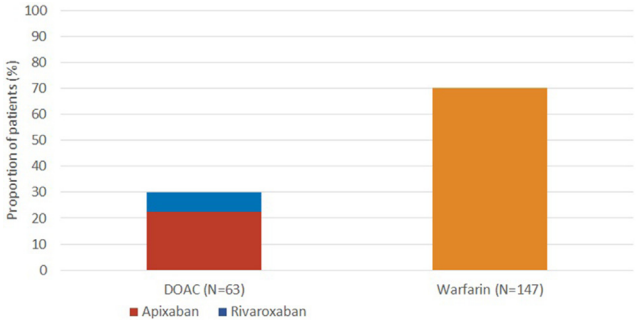

Figure 2. Proportion of patients discharged on DOAC or warfarin (n=210). DOAC, direct oral anticoagulants.

over warfarin, leading to the increase in use of DOACs over time seen in previous literature.

One of the main hesitancies to use DOAC early after cardiac surgery is the risk of bleeding. Our study showed that the risk of in-hospital bleeding was low in patients receiving oral anticoagulation postcardiac surgery. No patients in the DOAC group, and 2% of patients in the warfarin group, experienced pericardial effusion of any size, which is lower than the rate reported in previous studies.[16] Possible reasons for low rates of bleeding in our study compared with previous literature include single site (ie, specific surgical practices), differences in baseline bleeding risk, inconsistent documentation of bleeding events, and lack of postdischarge follow-up. Overall, it remains unclear if DOACs share a similar or lower risk of bleeding—particularly for hemorrhagic pericardial effusion—compared with warfarin or heparinoids.

The optimal time to start a DOAC after cardiac surgery remains unclear. Multiple studies of DOAC use after cardiac surgery examined the outcomes of starting DOACs 3 months after the original surgery.[21,22] Despite a delay in initiation of median of 5 postoperative days and minimal use of bridging, no strokes occurred in the DOAC group during the in-hospital study follow-up. Guidelines recommend delaying initiation of anticoagulation for procedures at high risk of bleeding (ie, cardiac surgery) by 48 to 72 hours.[23,24] The greater delay in initiating a DOAC relative to warfarin may have a practical explanation, as the standard practice at our centre is to remove pacing wires postoperative day 4, and therapeutic anticoagulation is usually delayed for this reason. It is reassuring that no stroke events occurred over the course of this 20-month study despite this local practice, and future studies on timing of DOAC use early after cardiac surgery may also consider a delayed initiation of DOACs after pacing wire removal (eg, on postoperative day 4 or 5).

A major reason to transition to DOACs is the logistical challenges associated with warfarin dosing. Despite a median length of stay of 9 days for the warfarin group, approximately one-half of patients on warfarin did not achieve therapeutic INR by discharge, and the majority did not receive bridging. This poses a possible thromboembolism-related risk, as it is unknown whether patients were able to achieve target INR soon after discharge. More than one-half of patients on DOACs before admission were switched to warfarin after cardiac surgery, but information regarding outpatient INR was not available in this study to verify adequate anticoagulation after this switch. In comparison, patients who were discharged on DOACs (either as a continuation of home therapy or a new start) would not have had similar concerns regarding thromboembolic event risk because of the fast onset of DOACs.

Given the findings of our current study, the aforementioned limitations, and the gaps that exist in the current literature further prospective, randomized research into DOAC use early after cardiac surgery would be required to evaluate the safety and efficacy of DOAC use in this population. The postcardiac surgery population is heterogeneous with regard to type of procedure and baseline bleeding and thromboembolic risk; hence, randomization is required to balance both the known and unknown confounders within this population. A prospective trial will allow for temporal follow-up of outcomes and postdischarge outcomes of bleeding and thromboembolism could be captured adequately. An ongoing prospective, randomized pilot study at St Paul's Hospital addresses these queries with a focus on the safety of DOAC use as well as the feasibility of using a standardized bridging regimen (Clinicaltrials.gov Identifier:

Table 3. Bleeding events

	DOACs (n = 63)	Warfarin (n = 147)
Bleeding event, n (%)	1 (1.6)	3 (2.0)
Bleeding-event description	One pleural effusion occurring on POD 13 after apixaban 5 mg twice daily was initiated on POD 7. A pigtail chest tube was inserted and drained 2L of "sanguinous" fluid over 3 days while maintaining a hemoglobin of 80-90 g/L.	*Started warfarin on POD 3 for POAF with no pre-existing indication and found to have a large pericardial effusion on echocardiogram on POD 14, requiring pericardiocentesis. 450 mL of serosanguinous fluid was drained, and warfarin was discontinued afterward. One pericardial effusion occurring on POD 8 not large enough to be drained. Warfarin was initiated on POD 1 and had reached therapeutic INR by POD 6. One hematuria occurring on POD 10 after warfarin initiated on POD 4. Therapeutic INR was not reached until POD 11, and heparin bridging was initiated on POD 7.

AF, atrial fibrillation; DOAC, direct oral anticoagulant; INR, international normalized ratio; POAF, postoperative atrial fibrillation; POD, postoperative day.
*One pericardial effusion occurring on POD 1 and was taken back to the operating room for drainage of tamponade.

NCT05006287).[20] Another ongoing study (**D**irect Oral **An**ticoagulation vs Warfarin After **C**ardiac Surg**e**ry [DANCE] trial) is a multicentre randomized controlled trial comparing DOAC with warfarin use in the first 30 days after cardiac surgery for patients with AF.[25] Results of these 2 studies will provide a clearer picture of DOAC safety and efficacy in patients who recently underwent cardiac surgery. Should further research determine that DOACs have similar or reduced rates of bleeding compared with warfarin, the current practice of switching from a DOAC to warfarin may also be reviewed as part of the clinical decision-making process.

Limitations

Some limitations to this study should be considered when interpreting these results. This study was based out of a single site located in Vancouver and may not reflect practices in other areas in Canada. The retrospective design may have led to inconsistent documentation of bleeding or stroke events. In addition, data were collected exclusively from the index hospitalization, as outpatient and external hospital documentation was not available. This may have excluded potentially relevant details such as bleeding events after discharge. Finally, this study was underpowered to detect a difference in bleeding rates, and further prospective studies are required to evaluate bleeding risk in patients on DOACs early after cardiac surgery.

Conclusions

In this retrospective cohort study, DOACs were used in approximately one-third of patients with indications for anticoagulation after cardiac surgery at a quaternary referral cardiac centre, with no significant differences in hospital length-of-stay or in-hospital bleeding or stroke events between the DOAC or warfarin groups.

Implication Statement

Literature on the early use of DOACs after cardiac surgery is limited. This retrospective cohort study characterizes early use of DOACs compared with warfarin in postoperative cardiac surgery patients with indications for anticoagulation.

Ethics Statement

The research reported has adhered to the relevant ethical guidelines.

Patient Consent

The authors confirm that patient consent is not applicable to this article, as this is a retrospective study using deidentified data.

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Disclosures

The authors have no conflicts of interest to disclose.

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