

Story #1

CSHP 2015 objective

Objective 2.1 - In 70% of ambulatory and specialized care clinics providing clinic care, pharmacists will manage medication therapy for clinic patients with complex and high-risk medication regimens, in collaboration with other members of the healthcare team.

Location of initiative

York Region Chronic Kidney Disease Program, Mackenzie Richmond Hill Hospital, Richmond Hill, ON

Team members involved

Renal pharmacists, nephrologists

Rationale for the initiative

Maintaining patients' INR within therapeutic range is challenging to most practitioners. It is even more challenging to manage warfarin therapy in hemodialysis patients. Factors adversely affecting hemodialysis patients' INR include: more drug interactions due to a high pill burden, more co-morbid conditions, frequent interventions requiring reversal of warfarin, and high pill burden resulting in non-adherence to medications. Inter-prescriber variation in warfarin dosing is also a contributing factor to INR fluctuations at our center, as hemodialysis patients are managed by a different nephrologist each week. To increase the time in therapeutic INR, warfarin sliding scales (WSS) were used in selected patients stable on warfarin (see Appendix 1). Most patients take warfarin at home as instructed by their nurses according to the WSS. For patients who are non-adherent to warfarin, warfarin is administered to them three times weekly in the dialysis unit according to a modified WSS (see Appendix 2).

Baseline data

Before the implementation of WSS, the rounding nephrologist of the week adjusted the warfarin doses for patients. About 45% of INRs were in therapeutic range with this traditional dosing method. Patient demographics are listed in Table 1.

Methods of implementation

Nephrologists select hemodialysis patients stable on warfarin to be dosed by the WSS. Upon receiving referral from a nephrologist, the renal pharmacist would review the patient's INR and warfarin dosing trends, design the WSS, and obtain approval of the scale from a nephrologist. Renal pharmacist would then counsel the patient and provide a warfarin calendar to the patient for documenting daily warfarin doses. The pharmacist also ensures that the patient has the correct warfarin tablet strengths. When required, dosettes are provided to patients to improve adherence to warfarin. INR and warfarin dosing trend is reviewed once a month, and the WSS adjusted if the patient's time in therapeutic INR is <50%. Adjustment of scale takes into account the patient's tablet strength at home to avoid multi-strength tablets, thereby reducing dosing errors.

Evaluation of results

From December 2010 to June 2012, 52 hemodialysis patients on warfarin were selected to be dosed by WSS. INR results 6 weeks before and 6 weeks after the implementation of WSS were compared. The primary outcome was percentage of time with a therapeutic (INR 2-3), sub- (INR <1.5) and supra-therapeutic (INR >4) INR. Secondary outcomes include bleeding or clotting events.

The majority of patients take their warfarin at home. Only 6 patients were administered warfarin on the unit. INR results are summarized in Table 2. The mean percentage of time in therapeutic INR 6 weeks before implementation of WSS was 45%, and the corresponding percentage 6 weeks after implementation was 53.3% ($p = 0.03$). Similarly, sub-therapeutic and supra-therapeutic INRs were reduced from 11.7% to 10.6% ($p = 0.69$) and from 5.48% to 0.98% ($p = 0.001$), respectively. No bleeding or clotting events were reported.

The implementation of WSS has resulted in significant improvements in time in therapeutic INR range, which leads to better therapeutic outcomes, such as lower stroke rates and lower bleeding risk. The home WSS also limits INR measurement to once weekly as compared to 1-3 times weekly with traditional dosing. The WSS is an innovative warfarin dosing method with many advantages: it allows automation in dosage adjustments, eliminates inter-prescriber variation, saves physician and nursing time, and reduces laboratory testing costs. Even with pharmacist resource constraints, the WSS has allowed active pharmacist participation in warfarin dosing. In the traditional dosing model, warfarin doses and INRs from the past 2 weeks were reviewed by a nurse with a physician over the phone. With WSS, pharmacists review INR and warfarin dosing trends over the past month or longer, therefore able to obtain a comprehensive view of the patient's anticoagulation control, and individualize dosing accordingly. Pharmacists also play an important role by assessing adherence, counseling patients and providing compliance aids. All of these efforts help patients better understand and adhere to warfarin therapy.

Pharmacist-designed WSS is a safe and effective approach for achieving therapeutic INRs. Pharmacist involvement in warfarin dosing and patient education plays an important role in successful anticoagulation management.

Table 1: Patient Demographics

Average age (range)	74.4 (44-91)
M:F	33:19
Type of WSS	Home: 46 (88.5%) Unit: 6 (11.5%)
Indication for warfarin	A Fib: 40 (76.9%) DVT/PE: 8 (15.4%) CVC patency: 2 (3.8%) Left ventricular thrombosis: 2 (3.8%)
Other anticoagulants	None: 29 (55.8%) ASA + warfarin: 17 (32.7%) Clopidogrel + warfarin: 5 (9.6%) ASA+clopidogrel+warfarin: 1 (1.9%)

Table 2: Results

	% INR, 6 weeks before WSS implementation	% INR, 6 weeks after WSS implementation	p-value
INR 2-3	44.95	53.25	0.03
INR >4.0	11.70	10.59	0.69
INR <1.5	5.48	0.98	0.001

No bleeding or clotting were reported during the study period.

Appendix 1: Example of a home warfarin sliding scale

Check INR once weekly

INR	Warfarin dose
1.5-1.7	6mg for 2 days, then 4mg daily thereafter
1.8-3.2	4mg daily
3.3-3.5	3mg daily x 2 days, then 4mg daily thereafter
<1.5 or >3.5	Call MD

Appendix 2: Example of a unit warfarin sliding scale

- Check INR every dialysis
- Warfarin is administered 3 times weekly in the dialysis unit. Patient will not take warfarin at home.

INR	Monday	Wednesday	Friday
1.5-1.7	4 mg	4 mg	6 mg
1.8-3.2	2 mg	2 mg	4 mg
3.3-3.5	1 mg	1 mg	2 mg
<1.5 or >3.5	Call MD		