ORIGINAL ARTICLE

IMPROVING VTE RISK ASSESSMENT IN HOSPITALISED PATIENTS IN A TERTIARY CARE HOSPITAL IN IRELAND

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Background: The initial baseline audit showed that only 24% of patients had a documented VTE-RA, this demonstrated an urgent need to improve VTE-RA in hospitalised patients. This quality improvement project (QIP) aimed to achieve 90% compliance in completing the VTE-RA tool and embedding this process into practice. Several measures were carried out which included the development of a TP policy, VTE-RA tool, education sessions and monthly point prevalence audits incorporating Plan, Do, Study, Act (PDSA) cycles. A follow-up audit was conducted one-year post-implementation using the same methodology as the baseline. **Methods:** This was a single centre before-after study, using a prospective cross-sectional design for both the baseline and post-intervention studies in a tertiary referral hospital in Cork, Ireland. All adult inpatients (>18 years) were eligible for inclusion. Documented evidence of VTE-RA and a prescription of TP were recorded. **Results:** The follow-up audit showed significant ($p < 0.001$) improvement in documentation of VTE-RA from 24% (244/1019) to 57% (612/1070) and the prescription of pharmacological TP increased significantly ($p<0.001$) from 43% (441/1019) to 67% (713/1070). This improvement in VTE-RA was highest in patients with an increased risk of thrombosis from 21.9% (n=180/819) to 61% (n=493/807). **Conclusion:** The introduction of a TP policy and VTE-RA tool increased compliance by 33%. However, without a dedicated multidisciplinary "thrombosis team" to actively implement this, the achievements to date are unsustainable and attaining 90% compliance with VTE-RA is unlikely.

Keywords: Venous thromboembolism; hospital-acquired thrombosis; multimodal intervention; PDSA; education; thromboprophylaxis; multidisciplinary team; Ireland

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INTRODUCTION

Hospital-acquired thrombosis (HAT) is defined as any venous thromboembolic (VTE) event that occurs within 90 days of hospitalisation or discharge.[1,2] Venous Thromboembolism (VTE) is the leading cause of preventable hospital death ahead of hospital-acquired infection.[3] HAT accounts for up to 10% of total mortality in hospitalised patients and contributes to significant morbidity amongst patients in the form of chronic embolic pulmonary hypertension and post-thrombotic syndrome.[4,5] For more than three decades, evidence-based consensus guidelines on the prevention of VTE have been proven to be both safe and effective.[5,6] Despite this, VTE continues to be associated with a major global burden of disease. In 2013, 3.9 million cases of HAT per annum were reported amongst 1.1 billion citizens of high-income countries.[7] At the time of this study, there was no standardised national programme in place for VTE prevention in CUH.

The use of a mandatory VTE RA tool and appropriate TP in hospitalised patients significantly reduces VTE incidence.[8] Many countries such as the United Kingdom (UK) have introduced mandatory RA tools and TP guidelines with a goal of 90% compliance.[9] To achieve this goal and to promote compliance a financial penalty was introduced which was linked with the Commissioning for Quality and Innovation (CQUINN).[10] This coordinated approach to VTE prevention in the UK helped to embed VTE risk assessment into everyday practice. Unlike the UK, Ireland does not have such a commissioning structure to promote compliance and relies on the active implementation of the VTE-RA and TP policy.

In 2014, Cork University Hospital (CUH), a tertiary referral centre, undertook an initiative to develop and implement a TP policy along with a VTE-RA tool. This quality initiative was in response to an initial audit which demonstrated that only 24% of inpatients had a formal risk assessment documented. It was identified that there was an urgent need to introduce a formal risk assessment process to enhance appropriate prescription of TP particularly for high-risk patients (a patient was considered high risk of

VTE if they had one or more risk factors for VTE without any bleeding risk factors).[11]

MATERIAL AND METHODS

This study was a single-centre before-after study, using a cross-sectional study design for both the baseline and post-intervention studies. Ethical approval was received from the Clinical Research and Ethics Committee (CREC) in 2014.

CUH is one of the largest university teaching hospitals in Ireland. Currently, it has a capacity of 800 beds and hosts more than 40 different medical and surgical specialities. It is a supra-regional centre for a total of 1.1 million people. All adult inpatients (>18 years) were eligible for inclusion in this study. Details of the inclusion and exclusion criteria have already been published.[11]

At baseline there was no formal TP policy or RA tool available in the hospital therefore the main outcome variable measured was whether or not a patient had documented evidence of VTE-RA in their medical notes and also a prescription for TP in their drug chart.[11] The main outcome measurement for the post-intervention study was whether or not a patient had their VTE-RA tool completed in the drug prescription chart along with the prescription of TP. If there was no documentation, the researchers risk assessed these patients in both the pre and post-audit using the medical information available to them in the patient's medical notes and drug prescription charts. Following risk assessment patients were stratified into three risk groups as per NICE[9], this included, high risk of VTE with low risk of bleeding; high risk of VTE with significant risk of bleeding and low risk of VTE. The proportion of patients in each group that received TP was calculated (NICE Clinical Guidelines 92., 2010).[9] Other variables collected were: patients' demographics, VTE risk factors, their VTE risk category, their admitting consultant and consultant speciality.

The outcome was binary and was coded as 0 when a patient's risk assessment was not completed and as 1 when a patient's risk assessment was completed. The proportion of RA completed, TP prescribed and thrombotic risk factors were calculated using cross-tabulations and p-values were calculated using chi-square. Data analysis was completed in SPSS for Windows.

Several studies were conducted in CUH between 2014 and 2016 to obtain baseline data on VTE incidence and the efficacy of prevention strategies. These included measuring the incidence of HAT in CUH 0.4% (n=48/12024) over a 4-month study period[12]. A national survey was conducted which determined the availability and use of a VTE-RA tool and a local TP policy. The response rate was 78% (n=31/40) and 75% of Irish hospitals reported that there was no TP policy and RA tool available locally.[13]

A baseline audit in CUH determined the current practices of VTE-RA and TP prescription in hospitalised patients revealing that only 24% (244/1019) of patients were risk assessed and 43% (441/1019) received TP[11]. Collectively, the results of these studies inspired the need to develop a policy to reduce the incidence of HAT through the implementation of a VTE RA tool with a target of risk assessing 90% of all hospitalised patients having a documented RA.

Once the results of the baseline audit were collected, a multidisciplinary team, the Hospital Thrombosis Group (HTG) was established under the lead of a Consultant Haematologist. All stakeholders were included, i.e., medicine, surgery, anaesthesia, acute medical unit, emergency department, pharmacists, research assistant and anticoagulation nursing staff. The results of this audit were reviewed and a series of PDSA cycles were initiated. A TP policy and a VTE-RA tool were developed using NICE 2010 guidance.[9] This mandatory RA tool was incorporated into the drug prescription charts and piloted for a month in the acute medical unit before implementation in July 2015. This introduction was planned to coincide with the induction of non-consultant hospital doctors (NCHDs) in the hospital. The TP policy is easily accessible on all hospital computers.

Education sessions regarding VTE morbidity, mortality and prevention were also initiated on a volunteer basis, members of HTG would present at sessions outlined in Table 1 to increase awareness and provide feedback on performance. These included feedback on audit results, both the initial audit and subsequent monthly audit results of randomly selected wards, as well as information on the TP policy and RA tool.

The education sessions included:

- Presentations at Grand Rounds in CUH, Mercy University Hospital, South Infirmary Victoria Hospital and University Hospital Kerry
- Teaching of (non-consultant hospital doctors) NCHDs at basic specialist training (BST) forum
- Intern teaching during induction every six months, i.e., in July and January
- Monthly tutorial teaching for final year medical students about morbidity and mortality of HAT
- Presentation at Nurses "Lunch and Learn" sessions and Nursing intern's preparation week
- Pharmacist education sessions, HAT presentations at Haematology Journal Club sessions

Efforts to raise awareness amongst the public and hospital staff included a partnership with the International Society on Thrombosis and Haemostasis (ISTH) organisation World Thrombosis Day (WTD). An information day was held in CUH on the 13th of October 2016. Information stands with a thrombosis quiz and prizes at all entry points to the hospital and the canteen. In addition, patient information leaflets were disseminated in pre-op assessment, admissions and outpatient departments. Patient information sheets were also sent out with patient meals on that day. Information about WTD and VTE was available via the WTD and CUH websites, and the CUH radio station and was tweeted via CUH and WTD Twitter accounts.

Point prevalence audits were conducted every month which included four wards and determined the proportion of VTE-RA documented as well as TP prescriptions. E-learning notices of the results and suggestions for improvements were created. However, due to a lack of resources needed feedback to the wards could not be completed, these e-learning notices were however sent to the clinical director of medicine for dissemination to other medical colleagues and NCHDs.

The CUH TP policy and RA tool were shared amongst the hospitals in South/South West Hospital Group (SSWHG) and nationally at the Haematology Association of Ireland (HAI) conference.

RESULTS

A total of 1070 patients were included in the post-intervention study. The majority of these patients were medical 64.3 % (n=689) and 27.1% (n=290) were surgical and 8.5% (n=91) were unknown. 64.3% (n=688) of patients were aged 60 years or older.

Post-intervention audit showed improvement in VTE-RA from 24% (244/1019) to 57% (612/1070) and the prescription of chemical TP also increased from 43% (441/1019) to 67% (713/1070). Post-intervention the proportion of VTE-RA documented increased by 33% from baseline and prescription of chemical thromboprophylaxis also increased by 24% from baseline (Figure-1).

75.4% of patients included in the study were classed as having a high risk of VTE with a low risk of bleeding whereas this proportion was 80.3% at baseline (Table-1). The improvement in RA was highest in patients with an increased risk of thrombosis from 21.9% (n=180/819) to 61% (n=493/807) increasing by 39.1% from baseline. Similarly, TP prescription also increased in this category from 46.3% (n=380) to 80.8% (n=652) rising by 34.5% from baseline (Figure-2).

Patient-related risk factors for VTE comparing baseline and post-intervention audit can be seen in Figure-3, each patient had one or more risk factor(s).

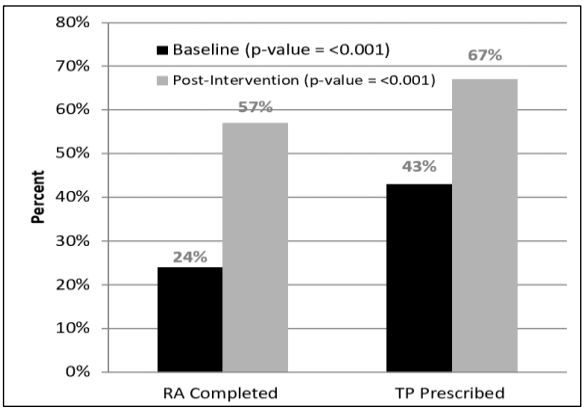

Figure-1: Proportion of patients who were risk-assessed and prescribed thromboprophylaxis at baseline and post-intervention

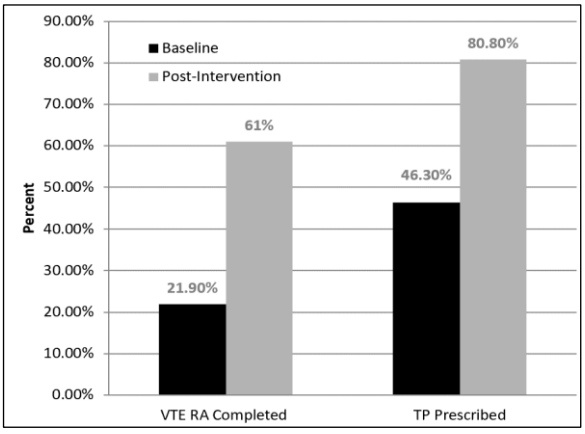

Figure-2: Patients at high risk of VTE with low risk of bleeding

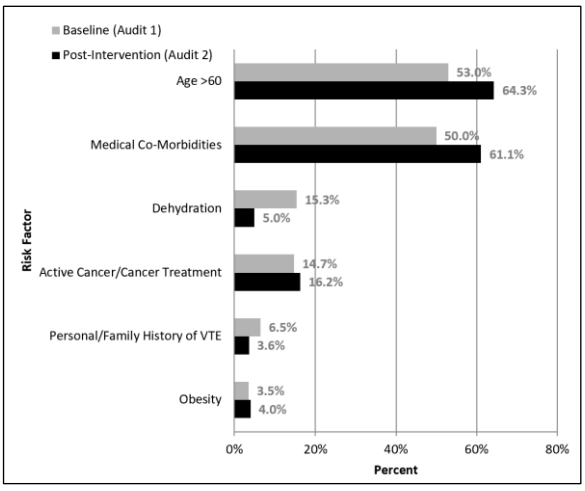

Figure-3: Common thrombotic risk factors in baseline and post-intervention audits

Table-1: Patients VTE risk stratification in post-intervention audit

	High Risk of VTE, Low Risk of Bleeding		High Risk of VTE, High Risk of Bleeding		Low Risk of VTE	
	Baseline (Audit 1)	Post-Intervention (Audit 2)	Baseline (Audit 1)	Post-Intervention (Audit 2)	Baseline (Audit 1)	Post-Intervention (Audit 2)
Number of patients	80.3% (n=819)	75.4% (n=807)	16.6% (n=170)	19.5% (n=209)	2.9% (n=30)	5% (n=54)
VTE risk assessment documented	21.9% (n=180)	61% (n=493)	32% (n=55)	50.7% (n=106)	30% (n=9)	24% (n=13)
TP Prescribed	46.3% (n=380)	80.8% (n=652)	28.8% (n=49)	26.3% (n=55)	40% (n=12)	22.2% (n=12)

Table-2: Recommendations for achieving goal

1	Educate medical and nursing staff.
2	Perform ongoing "snapshot" (point prevalence) audits with targeted feedback to poorly performing clinical teams and/or wards.
3	Introduce a root-cause analysis for newly diagnosed VTEs and investigate if the event is a HAT and if it may have been prevented. Provide feedback to consultants and teams on this and introduce interventions to prevent future occurrence.
4	Create and implement quality improvement initiatives using "Plan, Do, Study, Act" (PDSA) cycles.
5	Introduce an e-learning module on VTE prevention to be completed by all medical and nursing staff prior to commencing employment in the hospital. This module would include information on the local TP policy and VTE RA tool.
6	Improve patient awareness through liaison with patient focus groups and support groups.
7	Develop patient information materials such as leaflets and short films which would be made available around the hospital and shown on hospital television screens.
8	Utilise reminders such as stickers.
9	Introduce a computerised prescription of medication to the admitted patients with a compulsory pathway for risk assessment.

DISCUSSION

Before the introduction of a VTE-RA and TP policy in CUH only 24% of patients were risk assessed for VTE, which was considered a patient safety risk.[11] Similarly, on a national level, only 25% of Irish hospitals reported in a survey that had either a VTE-RA tool and/or TP policy with no formal process in place for auditing the use of the same.[13]

Once the VTE-RA tool and TP Policy were developed and made available the main focus of this quality improvement project was to ensure that at least 90% of hospitalised patients had documented evidence of the patient's VTE-RA. The post-intervention audit showed that adherence to documenting the risk assessment had increased significantly from 24% to 57% across the hospital (Figure-1).

The post-intervention audit found 75.4% (n=807) of inpatients to be at high risk of VTE (with low-risk bleeding) which was similar to the baseline audit 80.3% (n=819). Formal risk assessment of patients in this VTE category also increased significantly from 21.9% (n=180) to 61% (n=493), which is a threefold increase.

There was also a significant increase in the VTE-RA of patients with a high risk of bleeding from 32% (n=55) to 50.7% (n=106) (table-1). It's a well-known fact that the balance between bleeding and clotting must be considered when prescribing chemical TP. A "blanket approach", i.e., prescription of the same medication at the same dose and frequency in all patients may result in an increased risk of bleeding or being prescribed inadequate TP dose.[14,15] The benefits and harms must be assessed before the administration of TP and the VTE-RA tool facilitates this.

With the introduction of the mandatory VTE-RA tool and TP policy, the prescription of thromboprophylaxis increased significantly in the patients with high risk of VTE from 46.3% (n=380) to 80.8% (n=652). Similarly, as risk assessment increased in the patients with a high risk of bleeding the prescription of TP decreased from 28.8% (n=49) to 26.3% (n=55). As expected, patients in the category of low risk of thrombosis also showed reduced prescription of TP in the post-intervention audit from 40% (n=12) to 22.2% (n=12).

Previous studies have shown approximately 37% overall improvement in TP prescription is achieved with education alone in high-risk surgical and medical patients combined.[16] Other international studies have demonstrated that there was a 42%-58% increase in appropriate TP prescription of hospitalised inpatients when there was a concerted effort such as a nurse-led program was implemented to change hospital culture and embed VTE prevention processes into practice.[17,18]

Expert and enthusiastic multidisciplinary teamwork led to the initial improvement in the prevention of HAT strategy with the development of a TP policy and RA tool. However, this group was largely formed on a volunteer basis and is not sustainable or sufficient on its own to reach the pre-specified target of 90%. Resources are required such as a multidisciplinary "thrombosis team" to sustain, continue and spread improvement in VTE prevention.

After the VTE prevention efforts in CUH, in the past 12-18 months there has been a renewed culture of awareness of the need for change nationally. In 2016, the first National Safermeds Collaborative known as the VTE Improvement Collaborative was initiated by the Quality Improvement Division of the Health Service Executive (HSE) to which CUH contributed. This collaborative facilitates a series of

workshops providing quality coaching and guidance on how to implement quality improvement initiatives to change behaviour and assess the effectiveness of changes using the model for improvement which incorporates plan, do, study, act (PDSA) cycles.

VTE Ireland was also launched in October 2016 which aims to standardize efforts nationally (VTE Ireland 2016)[19]. This group consists of clinicians and aims to embed VTE RA into practice nationally. One proposed strategy is to implement the completion of the VTE risk assessment tool/appropriate prescription as a national key performance indicator (KPI). VTE Ireland also liaises with the patient group Thrombosis Ireland, which is a patient-run charity established in 2016 to raise awareness of thrombosis and patients' right to TP RA among service users and the general public. (Thrombosis Ireland 2016)[20].

Although there was an overall improvement of up to 57% (from 24%) in hospitalised patients risk assessed for VTE, the aim of 90% compliance is yet to be achieved. This improvement may be underestimated as the data collection method excluded some areas within the hospital such as cardiac intensive care. All cardiothoracic patients are risk assessed before transfer back to the ward from the cardiac intensive care unit and this data was not captured. However, it can be argued that their change in clinical condition requires an updated risk assessment on the transfer back to the ward. Similarly, the oncology team prescribe TP to all their patients provided their platelet count is above $50X10^9$/l, this is done without completing a formal RA. All patients with a prescription for TP within the audit could infer an informal risk assessment was completed however without documented evidence this cannot be confirmed.

Modifiers of possible effect factors were not taken into account such as the number of patients on each ward, the number of staff such as consultants, pharmacists and nurses or other environmental factors which may have had an impact on the results.

Recommendations

To achieve the goal of 90% VTE RA compliance, sustain improvements and ensure patients receive appropriate TP, it is highly recommended that the health service supports the establishment of a multidisciplinary "thrombosis team". This team should consist of a clinical lead, clinical nurse specialist(s), data manager and pharmacy input which would use a multi-modal approach to achieve their goal, see table-2.

CONCLUSION

Achieving improvement in VTE RA, appropriate TP prescription and embedding it into practice is difficult but achievable. Education alone is not enough to achieve 90% compliance. There is evidence that education of clinicians combined with other quality improvement measures and electronic support promotes effective RA, and TP prescription and reduces mortality and morbidity associated with HAT[1]. Health service support at a local and national level is imperative to provide the necessary resources to implement the plans outlined above leading to a measurable improvement in the safety and quality of care provided to service users. However, without a dedicated multidisciplinary "thrombosis team" to provide ongoing audit, feedback, education, root cause analysis and real-time intervention achieving the goal of 90% compliance with the TP policy, in keeping with international guidelines, is unlikely.

AUTHORS' CONTRIBUTION

MIK had the original idea for the study. MIK and SOS wrote the study protocol. MIK and COL collected data. MIK and AOB analysed the data. MIK, COL and AOB drafted the paper. SOS and CD agreed on the analysis and reviewed the draft versions. All authors approved the final version of the paper.

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