

The impact of the DoH Commissioning for Quality and Innovation incentive on the success of venous thromboembolism risk assessment in hospitalised patients. A single institution experience in a quality outcome improvement over a 4-year cycle

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Abstract

Objectives: To i) demonstrate compliance with the Commissioning for Quality and Innovation for venous thromboembolism risk assessment ii) to undertake root cause analysis of Hospital Acquired Thrombosis and to investigate its impact on quality of care.

Design: Prospective monitoring of all admissions.

Setting: Imperial College Healthcare Hospitals, London.

Participants: All Hospital Provider Spells as defined on the NHS Data Model and Dictionary.

Main outcome measures: i) Percentage of patients undergoing Venous Thromboembolism Risk Assessment (VTE-RA) at and 24-hours after admission ii) root cause analysis of Hospital Acquired Thrombosis up to 90 days following discharge.

Results: Over a 48-month cycle 83% were overall VTE-RA assessed with 36% in the first 12 months but with significant improvement to $\geq 95\%$ between April 2013 and April 2015, achieving compliance target since April 2012 involving a massive 633, 850 Spells over the 4 year period. We undertook root cause analysis of all VTE episodes from April 2013 to March 2014, to ascertain Hospital Acquired Thrombosis (HAT), we analysed 433, 174 inpatient days and found a HAT rate of 1 per 1000 with 23% and 24% for DVTs and PEs potentially avoidable respectively. We further analysed VTE risk stratification ($n=1000$) and found 37.0% at high risk, 44.4% at medium risk and 18.6% at low risk, indicating the need of thromboprophylaxis in 81.4% (high and medium) of whom 33.6% were excluded.

Conclusions: We achieved 95% RA compliance which has favourably impacted on our daily practice and improved the quality of the clinical care.

Keywords

Venous thromboembolism, deaths, risk assessment tool, Thromboprophylaxis, C-QUIN, hospital acquired thrombosis

Introduction

Venous thromboembolism (VTE) including deep vein thrombosis (DVT) and pulmonary embolism (PE) is a global health burden and is a significant cause of preventable mortality and long-term disability. VTE is the third most common cause of cardiovascular disease after myocardial infarction and stroke.¹ VTE was mentioned on the death certificate of approximately 17,000 deaths in England and Wales in 2007.² In the USA, approximately 100,000 die annually, mostly as sudden deaths, from VTE.³ Cohen et al found that nearly three quarters of VTE-related deaths were from HAT but only 7% diagnosed ante-mortem; 34% were caused by sudden fatal PE, and 59% followed undiagnosed PE.⁴ The overall VTE mortality in hospitals and the community is likely to be significantly higher as the condition is often missed. It is estimated that fewer than 1 in 10 fatal pulmonary emboli are diagnosed before death and due to a significant decline in post-mortems performed, VTE deaths are not identified at post-mortem. In 2005, the House of Commons Health Select Committee estimated an annual 25,000 HAT related fatalities in England with VTE being the immediate cause of death in 10% of all

hospital deaths,^{5,6} but the overall annual VTE related deaths in UK is likely to be higher and is estimated at 56,167 with the estimated death within the major six EU countries is over 370,000 deaths annually.⁴

VTE is primarily a problem in recently hospitalised patients being more than 100 times greater than in the community⁷ and approximately half of new VTE cases occurring during or within 90 days from the index HPS, with many are not diagnosed until after discharge.^{8,9} Moreover, up to 30% of first VTE event survivors have a recurrence within 5 years,¹⁰ up to 50% and 4 % develop post-thrombotic syndrome and chronic thromboembolic pulmonary hypertension following leg DVT¹¹ and acute PE respectively¹² and costing approximately £640 million per year in UK alone for treating VTE long term disability.⁴ The Institute for Healthcare Improvement has been identified HAT as a fairly frequent cause of harm (eight events per 1,000 HPS) and accounted for one out of 17 preventable deaths^{13,14}. Furthermore, the NHS Safety Thermometer (NHS ST) National Data reported a 3.5 per 1000 (0.35%) VTE related harm in over 4 million episodes.¹⁵ The emerging picture of death, acute and chronic disability leaves no room for complacency where cost effective preventive therapy is available, demonstrating relative risk reductions up to 60% with the use of the appropriate pharmacoprophylaxis.^{16,17}

The number of HATs has increased despite a heightened concerted global VTE awareness among patient safety experts, the Agency for Healthcare Research and Quality, DoH, NICE and the Centres for Medicare & Medicaid Services,¹⁸ with an average 550,000 adult HPS had a discharge diagnosis of VTE annually in USA alone.¹⁹ The National Quality Board and NHS Leadership team identified VTE prevention as an NHS clinical priority with Risk assessment being the trigger for VTE prevention with one of the main recommendations of the Chief Medical Officer's Expert Working Group Report (2007) that all hospital patients should receive a VTE risk assessment upon admission employing a unified national risk assessment tool which was launched shortly later.²⁰ The momentum to reduce VTE harm and death has further increased by linking it to CQUIN payment incentive framework²¹ and later root-cause analysis (RCA) on all confirmed HAT up to 90 days following discharge was introduced. In this report we outline our response and outcome of implementing VTE-RA in our organisation with 633, 850 Hospital Provider Spells (HPS) of whom 526, 267 underwent VTE risk assessment over a 4-year period.

Material and methods

We commenced data collection at all Imperial Healthcare NHS Trust hospitals from April 2011 and fed it to Unify 2, the NHS portal, later than the original date of 1 April 2010 in line with other NHS Trusts to allow time to develop local infrastructure and/or modify existing systems which are mostly paper-based and non-IT.

Compliance with the VTE quality indicator was calculated by quantifying the number and the proportion of all adult inpatients (≥ 18 years) who underwent VTE-RA on admission and at 24 hours according to the national RA tool clinical criteria. Once the data is fed to Unify 2, the monthly compliance percentage was automatically generated, documented but cannot be overridden. All hospital admissions ((patients as defined on the NHS Data Model and Dictionary definition of Hospital Provider Spell (patient classifications 1, 2, 3, 4 & 5)(elective, non-elective, maternity, transfers from other hospitals and day case admissions)) irrespective of the intended management were included. The data extracted include regular day care attendees were collectively included as patient cohorts, in these cohorts, patients are deemed as not at risk of VTE (for example haemodialysis patients and cataract surgery) or no pharmacological or mechanical prophylaxis would be appropriate regardless of the risk factors. These cohorts were clearly identified and were agreed with the Trust's Medical Director for exclusion. We used Electronic Discharge Communications (EDC) system and later Cerner Millennium to electronically capture VTE RA data covering circa 4000 admissions per month including data within the Trust's Maternity Systems (circa 2000 spells per month) which was extracted electronically from the maternity dedicated IT system. Any additional data were directly collected by VTE nurses, discussed and verified during the C-QUIN team periodic meetings with outstanding issues fed back to the clinical team.

For root cause analysis, cases with a VTE diagnosis were identified from the radiology databases (V/Q scans, CTPA scans) or Vascular Duplex laboratories (for duplex scans) and from death certificates via Patients Advice & Liaison Services (PALS). The RCA data was collated from the hospital notes by the VTE Team. Each case was then discussed with the respective admitting consultant and reviewed by a senior RCA site-designated member (mostly the haematologist) of the VTE Task Force for accuracy of assigning as HAT and adjudicated the event avoidability.

Results

In April 2011, the mean % of the data collected in the first quarter (Q1) was 22%. In the subsequent two

quarters, the figure remained more or less the same with a mean of 20% and 21% for Q2 & Q3 respectively. By Q4, a routine methodology was in place to have a handle on near full implementation and ready data collection with Q4 at a significant leap to a mean of 81% but the overall Y-1 mean remained low at 36%. In the subsequent 4 quarters the data collection targets were achieved at or above the intended target of 90% and overall annual mean of 91%. Similarly in year 3 (Y-3) & year 4 (Y-4) the quarter mean was above 95% with an annual mean of 96% and 96.5% for Y-3 and Y-4 respectively in compliance with the new elevated CQUIN target of $\geq 95\%$ (Table 1).

Up until March 2015 we analysed data on 633, 850 HPS of whom 526, 267 were VTE-RA on admission and at 24-hour post-admission representing 83% overall compliance over a 48-month and compliance over $\geq 95\%$ over the last 24 months. We undertook root cause analysis following its introduction as an additional CQUIN quality parameter for 2013–2014 with the data available including 186, 996 HPS and 433, 174 total bed days. At our trust, the overall HAT

events were lower than reported nationally at 1.07 per 1000 admissions including 0.55/1000 for DVT and 0.52/1000 for PE. The HAT rate varied between our 3 acute sites from 0.7-1.5/1000 HPS. Furthermore, we found that events which were deemed to be avoidable varied on the 3 sites ranging from 14-38% for DVTs and 14–39% for PEs with overall avoidable event rate by 23% of DVTs and 24% of PEs (Table 2) translating to an avoidable absolute rate 0.06 per 1000 HPS translating to the prevention of further 10 VTE per 150,000 HPS per annum.

Analysis of the avoidable events showed that lack of the VTE risk assessment in the first place was the main factor but performing the VTE risk assessment but not documenting it onto the EDC was further contributory factor. The reasons behind the variation on the 3 different sites are multifactorial but most importantly the varying clinical activity portfolio and case-mix complexity, for example one site being a major trauma centre, major cancer surgical site and major oncology service provider whereas one other site harbours the hyperacute stroke services, major neurosurgical and orthopaedic surgery as well as

Table 1. Quarterly C-QUIN compliance data.

Year	CQUIN compliance per quarter (% completed risk assessment)				Annual mean
	Q1	Q2	Q3	Q4	
Y-1 2011	22	20	21	81	36
Y-2 2012	91	91	91	91	91
Y-3 2013	95	96	96	97	96
Y-4 2014	95	96	97	98	96.5

Table 2. HAT root cause analysis.

	Number of admissions	Number of bed days	Number of VTE events	VTE per 1000 Admissions	% Avoidable	Avoidable rate per 1000 admissions
Site A	62,151	138, 024	DVT 34 PE 33	1.08	38% 39%	0.04
Site B	63,712	148, 874	DVT 20 PE 22	0.70	20% 14%	0.01
Site C	61,133	146, 275	DVT 49 PE 43	1.50	14% 19%	0.01
Overall	186, 996	433, 174	DVT 103 PE 98	O/A 1.07 DVT 0.55 0.52	DVT 23% PE 24%	DVT 0.13 0.12

Table 3. Risk stratification and percentage received pharmacoprophylaxis.

Risk Category	Number of patient (%)	Number excluded (%)	% received thromboprophylaxis
High	370 (37.0)	80 (21.6)	78.4
Medium	444 (44.4)	97 (21.8)	78.2
Low	186 (18.6)	All	0
Total	1000 (100)	363 (36.3)	63.7

tertiary vascular surgery. There are intensive care units on three sites with maternity on two of the three sites and coronary care on one site.

We analysed the VTE risk category of 1000 inpatients (table 3) and identified a potential need of pharmacoprophylaxis in 81.41% (high and medium) but further risk assessment excluded 36.3% of inpatients (all low risk, 21.6% high risk, and 21.8% medium risk) resulting in an overall pharmacoprophylaxis in 63.7% of inpatients.

Discussion

The efficacy of VTE prevention using a structured RA and administering the appropriate pharmacoprophylaxis is well established, is cost-effective and reduces VTE risk by up to 60%.^{16,17} The implementation of active strategies incorporating timely reminders for VTE-RA and selecting the appropriate prophylactic measure were shown to improve outcome,^{22,23} their long term uptake, however, have been disappointing. In the USA, it was mandated that hospitals use formalised tools for VTE-RA and instigate preventative measures.^{24,25} Effective policies to empower clinicians, improve knowledge and the use of a robust seamless support system to embed VTE prophylaxis into daily routine practice are mandatory. Raising VTE awareness among patients, carers and other healthcare professionals is another cornerstone for long-term success.

In UK, the high-turnover of shift based junior doctor system remains a real obstacle despite VTE induction being a common practice. Despite abundance of evidence, guidelines and protocols for VTE prevention in developed countries, full VTE prevention implementation remains an elusive objective. The global ENDORSE study has further highlighted this problem across 32 countries involving over 68,000 hospitalised patients of whom 55% were non-surgical. Based on ACCP criteria, overall 52% were judged to be at risk of VTE including 64% of surgical and 42% of medical inpatients. Only 59% of at risk surgical and 40% at risk medical patients received ACCP-recommended VTE prophylaxis

confirming a significant shortfall.²⁶ Moreover, Bergmann et al evaluated 37,000 medical inpatient in the same ENDORSE study²⁷ and found risk varied according to underlying diagnosis ranging from 31% to 100% but ACCP-recommended prophylaxis was underutilized with large differences observed among countries. In the UK, the trend is consistent with the global picture. Dr Foster Intelligence published The Hospital Guide 2009 highlighting patient safety and quality and in response to the specific question 'What percent of patients are risk assessed for VTE on admission' only 31% of trusts reported risk-assessment in more than 90% of admissions.²⁸

The joint DoH/NICE initiative and legislation have led to mandatory VTE risk assessment on at least 95% admissions since April 2013, we believe, as from our personal experience, this has led to a major healthcare quality improvement, the full long term impact of which will undoubtedly emerge in the next few years but the impact on VTE related deaths is already manifested as highlighted by several reports. Lester et al.²⁹ reported on VTE risk assessment using linked data from the Office of National Statistics (ONS) and Hospital Episode Statistics (HES), a statistically significant reduction in deaths (VTE is the primary cause) in hospitals achieving 90% VTE risk assessment with a relative risk (RR) 0.85 (95% CI 0.75 to 0.96; $p=0.011$) and a further reduction in fatal VTE with RR 0.61 (0.48 to 0.79; $p=0.0002$) was demonstrated for both surgical and non-surgical patients but found no effect on day case admissions and non-fatal VTE readmissions up to 90 days.²⁹ Furthermore, Catterick and Hunt I used data from the Health and Social Care Information Centre and ONS and observed a 9% reduction in the estimated mean VTE-related secondary diagnosis ($p=0.001$). Similarly a 4% reduction in mean 30-day and 90-day VTE-related readmission rates were observed. The observed annual VTE-related national mortality was reduced by 9% and 8% for two consecutive years.²⁷ Both studies^{29,30} concluded that the national quality initiative has resulted in a significant reduction in VTE mortality. The NHS ST

National Data Report¹⁵ has further confirmed the improved VTE risk assessment uptake on over 4 million episodes surveyed. The proportion of patients with a documented VTE risk assessment in the acute settings is over 88%. The proportion of 'at risk' patients receiving appropriate prophylaxis in the acute setting is approximately 82%. The proportion of patients that are receiving treatment for a clinically documented VTE event (old or new) has reduced by 21% and for new clinically documented VTE event in the acute setting has reduced by 27%. The proportion of patient admissions with a VTE coded in HES is 0.58% compared to 0.53% from the NHS ST.¹⁵ Moreover, VTE occurrence in specific patient group was reported by Dyer et al using HES and identifying 0.66% (n = 839 patients) readmission with VTE including 0.29% DVT and 0.37% PE within 12 months following common urological procedures on 126,891 patients in keeping with HES and NHS ST data.³¹

In our trust, implementing the VTE assessment has been a challenging task. HAT was recorded at a lower rate than nationally reported at 1.07 per 1000 (0.11%) admissions, including 0.55/1000 (0.06%) for DVT and 0.52/1000 (0.05%) for PE with additional potential 23% avoidable DVTs and 24% avoidable PEs translating to a further reduction to 0.42/1000 and 0.40/1000 for DVT and PE respectively. Our data compares favourably with HES data in of 5.8 per 1000 admissions. The VTE reduction in our trust was in part triggered by a major trust policy change in 2005 when we reported a gross underutilization of thromboprophylaxis in hospitalised medical patients.³² Despite lack of proper data collection before 2011, our trust has always had a major emphasis on VTE prevention practice for very long time in view of the vested academic interest in the area which might have contributed to the lower rate of HAT. We believe that our data is a real reflection of the major advance been made in this area. Future research in this area should focus on refining risk assessment models for VTE prevention in hospital and the community.

Declarations

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Guarantor: AS

Contributorship: AS drafted the original and the revised final manuscript, adjudicated the Root Cause Analysis (RCA) for Hospital Acquired Thrombosis (HAT) at SMH site and the overall data analysis. CB analyzed the final RCA for the whole trust, revised the original draft and led on the final data output approval. PS and VA liaised with clinicians and nursing staff on

missing data and ensured all data are available for the regular CQUIN group meeting in association with IT department. GJ provided the IT leadership and support for the data collection and analysis.

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