Geriatric Orthopaedic Surgery
& Rehabilitation
2015, Vol. 6(3) 157-159

DOI: 10.1177/2151458515583087
gos.sagepub.com
SAGE

A Stab in the Dark? Point-of-Care Testing in the Population With Hip Fracture

Claire Dawkins, MBBS, MRCS[1], Kate Atkinson[2], Anne Tate, RGN, BSc(Hons), ONC[2], and W. G. P. Eardley, MSc, MD, PgCertMedEd, Dip, SEM(UK&I), FRCSEd(Tr&Orth)[2]

Abstract

Hip fracture incidence rises globally in an aging population who live in an era of financial austerity. Health service providers are under pressure both to optimize care and to increase efficiencies in the management of this vulnerable patient group. One area of inefficiency in perioperative processes is the assessment of deranged clotting profiles secondary to warfarinization and in the monitoring of hemoglobin. Delays are inherent in these processes, threatening patient care and impacting on financial incentivisation of performance. Point-of-care testing, while widespread in other areas of health care, is underutilized in hip fracture management. This work explores the application to hip fracture care of this technology and suggests future direction to investigate its potential benefits.

Keywords

hip, fracture, warfarin, hemoglobin, point of care

The fractured hip represents a major public health issue, and by 2050, its global incidence will exceed 6.3 million cases.[1] Optimal care for this growing, increasingly frail population relies, among other factors, upon efficient assessment of hemoglobin (Hb) and international normalized ratio (INR) parameters to guide surgical timing and resuscitation. We have previously shown that inefficient laboratory investigation processes increase surgical delay in patients with hip fracture,[2] and one way of potentially improving this unsatisfactory situation is through the introduction of point-of-care testing (POCT). The literature surrounding POCT however is heterogeneous, rendering systematic review meaningless. There are no reports of the use of POCT processes in patients with hip fracture. Due to the heterogeneity of available evidence and absence of data specifically for hip fractures, we provide an overview of POCT evidence to inform clinicians involved in hip fracture surgery and propose direction for further investigation.

Therapeutic anticoagulation is a cause of morbidity and delay to surgery in the patient with hip fracture.[2] Currently, 950 000 of the UK population are taking warfarin and this figure rises by 10% each year.[3] As well as anticoagulation management, anaemia is a significant feature of the patient group having hip fracture, increasing falls and overall mortality.[4,5] It appears logical therefore that substituting laboratory sampling for serial perioperative Hb and INR POCT has the potential to identify complications early, decrease time to surgery, and aid in recovery.

Linking these investigations with current health care processes, nurse-led care has become an integral aspect of patient-centered best practice. It is cost-effective and results in better functional outcomes for patients.[6-8] Bringing the test to the patient therefore embraces optimal nursing care and removes the logistical element of laboratory testing. Point-of-care testing takes less time to collect, negates preparation or packaging costs, and yields an instant result.[9,10] This enables more punctual decision making, improving patient care and reducing length of stay.[2]

As well as time, cost is a vital factor when considering a change in health care process. Financial aspects of patient care however are often so multifactorial that cost savings are difficult to measure meaningfully. Point-of-care testing requires equipment (machine, disposables, and reagent), maintenance, and calibration as well as costs for training and competency assessment. Balancing these costs are theoretical savings

[1] James Cook University Hospital, Middlesbrough, United Kingdom
[2] Department of Trauma & Orthopaedics, James Cook University Hospital, Middlesbrough, United Kingdom

Corresponding Author:
W. G. P. Eardley, Department of Trauma & Orthopaedics, James Cook University Hospital, Middlesbrough, United Kingdom.
Email: willeardley@doctors.org.uk

gained by decreasing delays inherent with laboratory testing although there is little evidence to substantiate this.

On reviewing the available evidence, 2 main features characterize POCT literature for both Hb and INR monitoring: accuracy and cost. For Hb, in various clinical areas (blood transfusion, intensive care, and gastrointestinal bleeding units) Hb POCT has been studied but low numbers, poor methodology, and lack of uniformity in device use render it impossible to generalize findings to the population with hip fracture. Highlighting the heterogeneity of the available evidence, it is possible to find both enthusiastic support and damning indictment of Hb POCT in comparable study populations. When evaluating INR POCT accuracy, the significant issue is the wide range of confidence intervals seen when mean INR between capillary POCT and laboratory venous samples is compared. Jennings et al reveal that POCT INR readings may be as much as 0.76 INR units above or below the laboratory value.[11] This discrepancy has significant implications if decisions on operative priority and anesthesia techniques are being informed by these devices.

Accuracy is clearly an issue and this threatens the safe application, in isolation, of the results generated by POCT devices. This restrained approach is corroborated by the literature. For each study recommending POCT uptake and commending reliability, there is a cautionary counterpoint from work carried out in a similar population advising against its uptake. What can be distilled from this review and where studies are in agreement is that training in taking the samples in POCT has considerable impact on the accuracy of capillary testing against a presumed gold standard of laboratory venous analysis. With correct training, competency assessment and regular calibration of testing materials coordinated by a dedicated POCT facilitator, concerns over accuracy *may* be minimized.

Following on from accuracy, the second issue is that of cost. Fitzmaurice et al in a family medicine study provide the only evidence for the financial impact of POCT, reporting in their warfarinized population a cost of £1751 for INR POCT compared to £2290 for laboratory equivalents.[12] This is an uncontrolled single study performed in a community setting and has little that can be generalized to hip fracture care.

Accepting the paucity of the available evidence base, potential cost savings *are* achievable with POCT. Although there is no discrete evidence for this in the population with hip fracture, as a surrogate, there is firm indication of the considerable financial benefit of minimizing surgical delay through the rapidity of POCT, particularly in terms of best practice tariff financial uplifts. In UK hospitals, for instance, if a single patient is prevented from breaching the national 36 hour time to theater from admission target by optimizing warfarin reversal,[2] the entire cost outlay for POCT for the financial year in that unit are recovered through performance incentive payments. The cost balance therefore is theoretically in favor of POCT and the introduction of a program to monitor Hb and INR certainly does not appear cost prohibitive. Most importantly to clinicians, currently no robust economic evidence is available for cost impact of these devices in the population with hip fracture, which is surprising considering the number of patients involved.

For surgeons, nurses, and managers, scanning the future landscape of fragility fracture care, the number of cases of hip fractures on the horizon is daunting. Point-of-care testing has the *potential* to improve efficiency and outcome and considering the potential benefits in such a large population is currently underinvestigated. We suggest that all centers providing hip fracture care should either undertake research themselves or collaborate with other units to investigate the use of POCT in their patients. The large numbers generated by such collaboration will rapidly accrue the sampling size required to determine clinical significance of POCT interventions and identify any unacceptable variation in results. Prospective observational collection of duplicated POCT and laboratory samples taken as part of the routine perioperative assessment of patients with hip fracture will enable pragmatic analysis of discrepancies between the techniques. It could allow for assessment of the impact of training using a pre- and postinstruction cohort in a repeated measures design. Should the use of POCT in isolation prove safe in the population with hip fracture through these observational studies, further follow on investigation utilizing randomization into POCT and laboratory testing groups could be performed. This would definitively answer questions regarding financial impact, length of stay, and time to surgery implications.

This technology has the potential to reinforce patient-centered, efficient, nurse-led hip fracture care, both minimizing delays and maximizing remuneration. In order to definitively address the limiting issues of accuracy and cost impact, robust data collection will further inform the clinical community, and we encourage our colleagues in joining us in addressing this evidence void.

Declaration of Conflicting Interests

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Funding

The author(s) received no financial support for the research, authorship, and/or publication of this article.

References

1. Management of hip fractures in adults [Internet]. United Kingdom: National Institute for Clinical Excellence; 2012 [updated November 26th 2012;]. Web site. http://www.nice.org.uk/guidance/cmg46. Accessed August 18, 2014.
2. Eardley WG, Macleod KE, Freeman H, Tate A. ''Tiers of delay'': Warfarin, hip fractures, and target-driven care. *Geriatr Orthop Surg Rehabil*. 2014;5(3):103-108.
3. Connock M, Stevens C, Fry-Smith A, et al. Clinical effectiveness and cost-effectiveness of different models of managing

long-term oral anticoagulation therapy: A systematic review and economic modelling. *Health Technol Assess*. 2007;11(38):iii, iv, ix-66.
4. Dharmarajan TS, Norkus EP. Mild anemia and the risk of falls in older adults from nursing homes and the community. *J Am Med Dir Assoc*. 2004;5(6):395-400.
5. Bhaskar D, Parker MJ. Haematological indices as surrogate markers of factors affecting mortality after hip fracture. *Injury*. 2011; 42(2):178-182.
6. Cullum N, Spilsbury K, Richardson G. Nurse led care. *BMJ*. 2005;330(7493):682-683.
7. Griffiths P, Harris R, Richardson G, et al. Substitution of a nursing-led inpatient unit for acute services: Randomized controlled trial of outcomes and cost of nursing-led intermediate care. *Age Ageing*. 2001;30(6):483-488.
8. Griffiths PD, Edwards MH, Forbes A, Harris RL, Ritchie G. Effectiveness of intermediate care in nursing-led in-patient units. *Cochrane Database Syst Rev*. 2007;(2):CD002214.
9. Crook MA. Near patient testing and pathology in the new millennium. *J Clin Pathol*. 2000;53(1):27-30.
10. Jahn UR, Van Aken H. Editorial I: Near-patient testing—point-of-care or point of costs and convenience? *Br J Anaesth*. 2003; 90(4):425-427.
11. Jennings I, Luddington RJ, Baglin T. Evaluation of the ciba corning biotrack 512 coagulation monitor for the control of oral anticoagulation. *J Clin Pathol*. 1991;44(11):950-953.
12. Fitzmaurice DA, Hobbs FD, Murray ET. Primary care anticoagulant clinic management using computerized decision support and near patient international normalized ratio (INR) testing: routine data from a practice nurse-led clinic. *Fam Pract*. 1998;15(2):144-146.