Original Article

The Effect of Point of Care Testing on Clinical Decision Making in an Emergency Department

Memon N. Illahi, Ruth Lapworth, Philip Bates

ABSTRACT

A Point of Care Testing (PoCT) laboratory for the analysis of wide range of biochemistry and haematology tests has established at Emergency Department at the Kent and Canterbury Hospital.

OBJECTIVE: To evaluate the speed at which test results were available comparing turn around time between PoCT and main pathology laboratory and whether this had an effect on clinical decision making was undertaken.

DESIGN AND METHODS: Blood samples from 47 patients were sent randomly either to the main laboratory for analysis or to the PoCT facility in the Emergency Department.

RESULTS AND DISCUSSION: The results of samples analysed in the PoCT laboratory were available 54 minutes faster and senior clinical decision time reduced by 38 minutes when compared to the main laboratory. Delays in clinical decision occurred when samples initially analysed in the PoCT laboratory required further pathology tests only available in the main laboratory. A further suggestion for the inclusion of checking Troponin I, D-Diemers, Salicylates, clotting screen and alcohol levels would have been useful if done to reduce decision making time thus improving patient management. Opening times of the PoCT were limited (10-17hours), small number of patients included in the study (n=47) and generic outcome measures such as mortality were not addressed.

CONCLUSION: This small study shows a significant benefit of PoCT on clinical outcomes by significant decrease in time by early availability of the blood test results compared to the main pathology laboratory making clinical decision quicker.

KEY WORDS: Blood Samples, Laboratory, Emergency Department, Haematology.

INTRODUCTION

Point of Care Testing (PoCT) is now defined as 'any test that is performed at the time at which the test results enables a decision to be made and an action taken that leads to an improved health outcome'. [1] The benefits of PoCT on clinical outcomes measures for patient care have been debated for many years [2, 3, 4] It is widely acknowledged that introduction of PoCT into an emergency care department can improve turnaround time for pathology tests compared to the main laboratory (5, 6) and comparable quality of results (7). However, in a randomised controlled trial for PoCT, the faster availability of results did not affect clinical outcome or the amount of time patients spent in the Accident and Emergency department.[8] It has been argued that the 'therapeutic turnaround time' i.e. the time between the decision to test and the initiation of a therapeutic intervention is a more meaningful measure of outcome for PoCT as any intervention may lead to a change in outcome. [9, 10, 11]

This study has been conducted to determine how long patients waited after their arrival in the ECC to have their blood sample taken and to compare the speed by which results are available to doctors in the Emergency Department using PoCT and the main laboratory as well as to determine whether PoCT facilitates faster senior decision making with regard to admission or discharge from the ECC (the therapeutic turnaround time).

MATERIAL AND METHOD

In 2009 a dedicated PoCT laboratory analysing samples for a variety of biochemistry and haematology tests (Table) start working in Emergency Department (ECC) of Kent & Canterbury Hospital. This department provides emergency care to GP and direct patient referrals but does not accept trauma patients. The PoCT laboratory is staffed by personnel from the main hospital laboratory on a rotational basis rather than clinical staff undertaking the analysis. This facility superseded the use of the hospital's main blood sciences laboratory for basic pathology tests requested on ECC patients. At the time of this study the PoCT laboratory was unable to provide clotting, d-dimer or troponin results. A certain proportion of blood samples sent to the PoCT laboratory for initial analysis are then re-routed to the main hospital laboratory for further analysis.

A proforma was designed to collect data prospectively,

from patients presenting to the ECC during two weeks in March between 10:00 and 17:00 hours. Blood samples were collected in the usual way and then randomly allocated for analysis either in the main blood sciences laboratory located in another part of the hospital or in the PoCT laboratory based in the ECC.

Analysis in the PoCT laboratory was undertaken by senior assistant healthcare scientists trained and competent in laboratory procedures using a Siemens Dimension Xpand Plus analyser (Siemens Healthcare Diagnostics Ltd, Sir William Siemens Square, Frimley, Camberley, Surrey GU16 8QD) and a Sysmex XS 1000 analyser (Sysmex UK Ltd, Sysmex House, Garamonde Drive, Wymbush, Milton Keynes MK8 8DF) with bidirectional links to both analysers with the laboratory information system (LIMS). Results within predefined ranges were validated automatically, with any abnormal results being validated remotely by a qualified biomedical/clinical scientist in the main laboratory following standard operating procedures.

The process by which blood test results are obtained for samples sent to the main hospital laboratory, the PoCT laboratory or to the PoCT laboratory then the main laboratory is given in Figure I.

TABLE: REPERTOIRE OF TESTS AVAILABLE IN PoCT LABORATORY

Clinical Biochemistry	Haematology
Albumin Alkaline Phosphatase Amylase Bilirubin Calcium Creatinine CRP Glucose Paracetamol Phosphate Potassium Sodium Urea	Full Blood Count Five part differential on the White Blood Cell Count (WBCC)

RESULTS

Data was collected on 47 patients (25 female, 22 male) with an average age of 62 years (range 18-100). Patients had blood samples collected for pathology tests on average 48 (1-97) minutes after their arrival in ECC (Figure II). Twenty nine samples were sent to the main hospital laboratory for analysis and 18 to the PoCT laboratory. Blood results for samples sent to the main laboratory were available on average 102 (52-243) minutes after the blood sample was taken in ECC. Results were available for samples sent to the PoCT laboratory on average 48 (25-82) minutes after the patient sample collected (Figure III).

Of the 29 samples sent to the main hospital laboratory, a senior clinical decision took an average of 155 (40-314) minutes from admission (Figure IV). A delay in clinical decision making while awaiting blood results

FIGURE II: TIME BETWEEN PATIENT ARRIVAL IN ECC AND BLOOD SAMPLE BEING TAKEN (n=47)

Number of Patients	1	5	4	10	8	5	6	2	4	2
Time blood taken	1-10 mins	11-20 mins	21-30 mins	31-40 mins	41-50 mins	51-60 mins	61-70 mins	71-80 mins	81-90 mins	91-100 mins

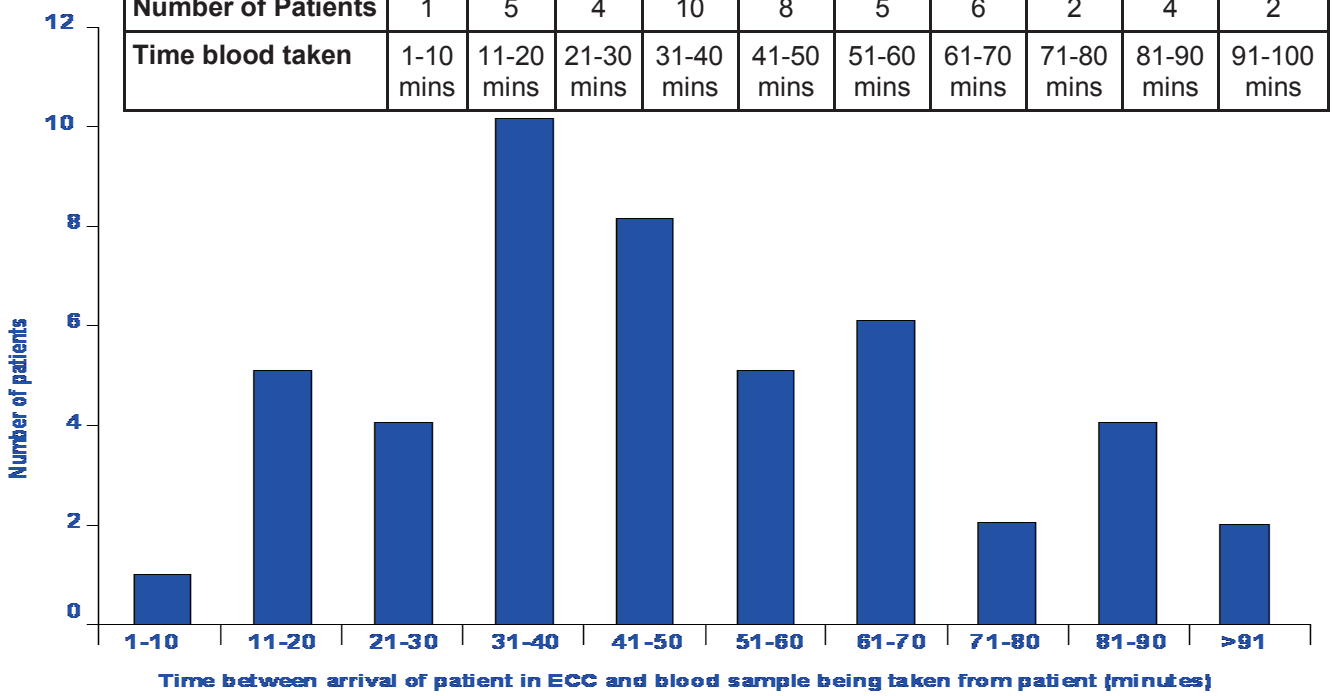
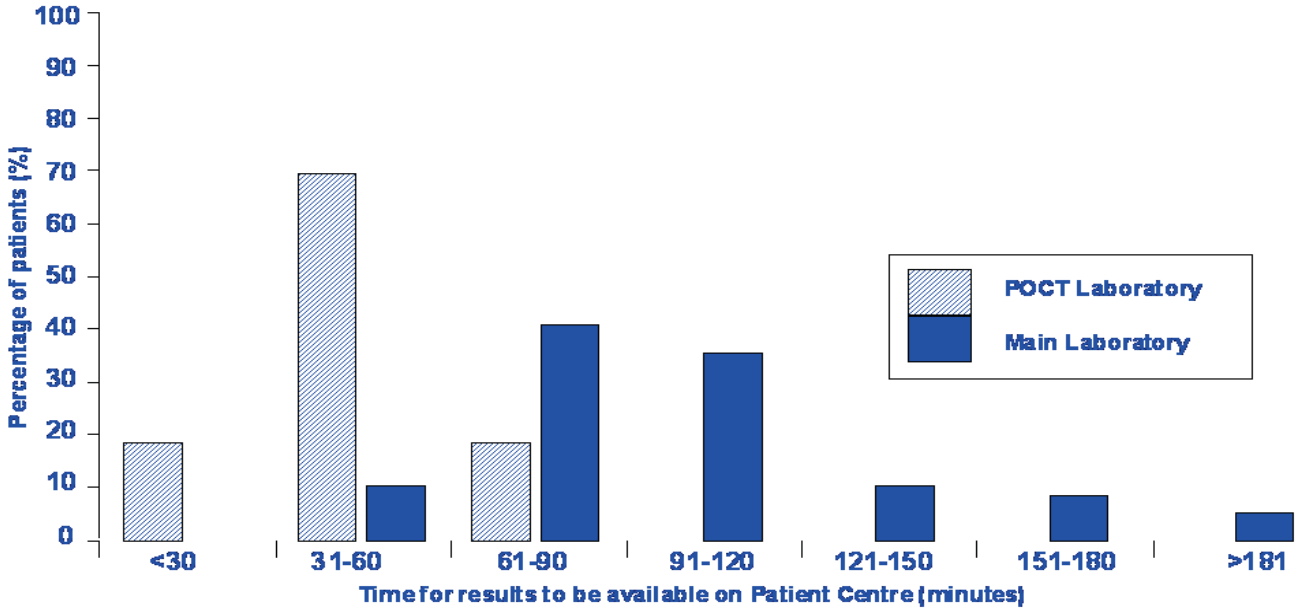
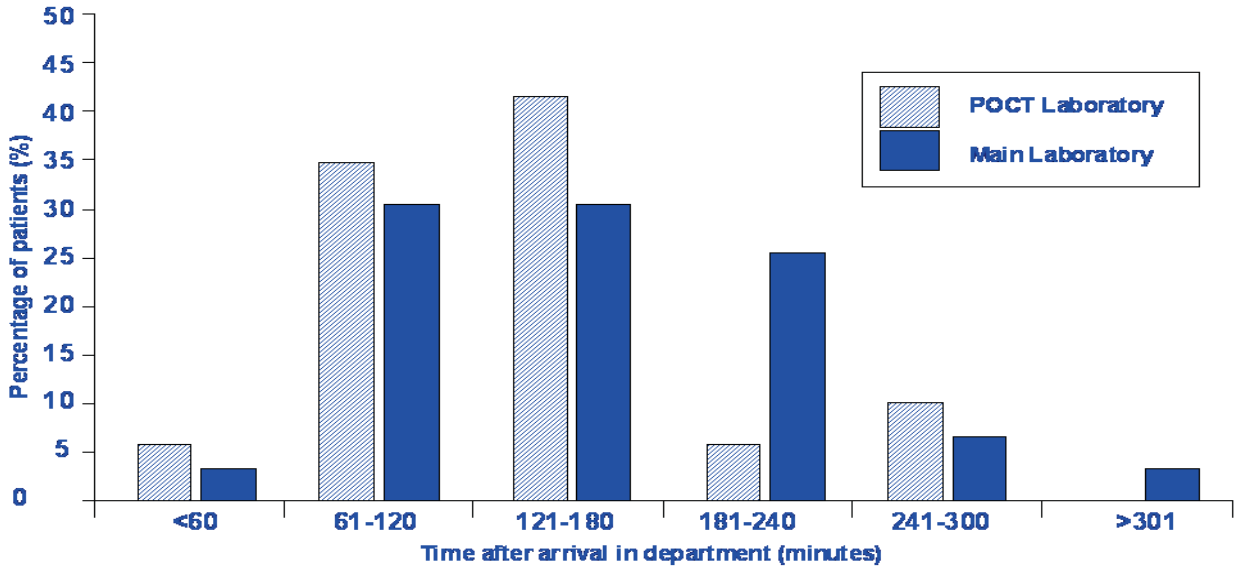


FIGURE III: TIME BETWEEN SAMPLE TAKEN FROM PATIENT AND RESULT AVAILABLE IN ECC



PoCT – Results available in mins	Time<30mins	31-60mins	61-90mins	91-120mins	121-150mins	151-180mins	>180 mins
PoCT number of patients (and %)	3pts = (17%)	12pts= (66%)	3pts = (17%)	0	0	0	0
Main Laboratory		4pts=(13.8%)	12pts=(41.3%)	10pts=(34.5%)	3pts=(10.4%)		

FIGURE IV: TIME AFTER ARRIVAL IN ECC UNTIL SENIOR CLINICAL DECISION REGARDING MANAGEMENT



Senior decision minutes	Time<60 mins	61-120 mins	121-180 mins	181-240 mins	241-300 mins	> 300 mins
PoCT Lab (pts)	1 = 5.6%	6 = 33.3%	8 = 44.4%	1 = 5.6%	2 = 11.1	__
Main Lab (pts)	1 = 3.5%	9 = 31%	9 = 31%	7 = 24.1%	2 = 6.9%	1 = 3.5%

occurred on 9 occasions.
Of the 18 samples sent to the PoCT laboratory, a clinical decision took an average of 136 (30-246) minutes from admission to ECC. This includes delay by sending 8 samples to the main hospital laboratory for further tests such as d-dimer, clotting or troponin. If these results are excluded, than clinical decision for samples sent to the PoCT laboratory decreased to an average 117 (30-155) minutes from admission.

DISCUSSION

The ECC is a dedicated department for Emergency Medicine and this study demonstrates a significant advantage in having the PoCT laboratory in the ECC department as it means results are available much sooner and this can reduce the admission-to-clinical decision time. This time could be further reduced if troponin and d-dimer measurements were also available, as patients waited, on average, a further 19 minutes if a clinical decision required urgently e.g. anti-ischaemic treatment or Doppler ultra-sound of the leg [12, 13, 14, 15].

The average age of patients in this study was 62 years which is typical of those presenting with a potential myocardial infarction. It therefore makes sense to measure troponin by PoCT. However, most patients present less than 12 hours after the onset of chest pain so the immediate availability of troponin using PoCT would only benefit those patients presenting more that 12 hours after the chest pain started.
D-dimer is often used as a diagnostic tool for low suspicion of DVT and PE meaning that many patients can be discharged if the d-dimer is negative. There is also a DVT clinic operating from 09:00-17:00 hours in the ECC. Availability of d-dimer by PoCT would potentially reduce waiting times [12] in the DVT clinic as well as the ECC. As most DVT patients are seen during the day this service only needs to be available during these hours and would not need to be a 24 hour service.
Provision for PoCT for other tests such as salicylate, clotting, and alcohol would be useful but is not essential for immediate patient management.
Although the PoCT laboratory offers the opportunity, patients waited an average of 48 (1-97) minutes after admission to have blood samples taken, and then another 48 minutes for the results to be made available. This was 96 minutes for a decision to be made by a senior physician. If blood samples could be taken routinely (where necessary) by a nurse/HCA within 30 minutes of admission and the PoCT repertoire expanded to include Troponin and D dimer the "admission-to-decision" time could be further reduced.
There are, however, many more causes for delays in decision making, including the time it takes for a patient to be clerked by a junior doctor, time waiting for other diagnostic procedures to be carried out and finally the availability of Senior Clinicians (SpR or Consultant) to review the patient.
The delays in availability of main laboratory results were due to many reasons. The samples to be sent to the laboratory are put into a basket in ECC and taken to the laboratory by hospital porters as there is no vacuum tube transport. At busy times the samples can be left for up to an hour before collection. Due to the large number of samples analysed in the main laboratory the results can take longer to verify and be made available on the computer system. In comparison, samples are taken to the PoCT laboratory directly by the member of staff that has collected the sample, and analysed immediately. There are significantly fewer samples analysed in the dedicated PoCT laboratory and so results can be made available sooner.

Limitations of the study:

This study was limited to the opening hours of the PoCT laboratory i.e. 10:00–17:00 hours.
This study is limited by the small number of patients studied.
This study has not focused on generic outcome measures such as mortality or hospital length of stay. In addition, other measures of outcome including indices of patient satisfaction and acceptability to clinical staff working in the unit delivering patient care need to be taken into consideration.
The improvement in clinical decision times observed in this Emergency Department may not reflect those achievable on other sites dealing with a wider variety of patients such as paediatrics, trauma, obstetric and gynaecology.

Acknowledgements

Healthcare support staff provided the analysis.

REFERENCES

1. Point of Care Testing for Managers and Policy Makers. Price CP & St John A, American Association for Clinical Chemistry (ACc) Press, 2006.
2. Parvin CA, Lo SF, Deuser SM, et al. Impact of point of are Testing as Patients' Length of Stay in a large Emergency Department. Clin Chem 1996;42:711-7.
3. Murray RP, Leroux M, Sabga E, Palatnick W, Ludwig L.Effect of point of care testing on length of stay in an adult emergency department. J Emerg Med. 1999 Sep-Oct;17(5):811-4.
4. Lee-Lewandrowski E, Corboy D, Lewandrowski K, Sinclair J, McDermot S, Benzer TI. Implementation of a point-of-care satellite laboratory in the emergency department of an academic medical center. Impact on test turnaround time and patient emergency department length of stay. Arch Pathol

Lab Med. 2003 Apr;127(4):456-60.
5. Sidelmann JJ, Gram J, Larsen A, Overgaard K, Jespersen J. Analytical and clinical validation of a new point-of-care testing system for determination of D-Dimer in human blood. Thromb Res. 2010 Dec;126(6):524-30.
6. Hedberg P, Wennecke G. A preliminary evaluation of the AQT90 FLEX Tnl immunoassay. Clin Chem Lab Med. 2009;47(3):376-8.
7. Fermann GJ, Suyama J. Point of care testing in the emergency department. J Emerg Med. 2002 May;22(4):393-404.
8. Kendall J, Reeves B and Clancy M. Point of care testing: randomised controlled trial of clinical outcome BMJ. 1998 April 4; 316(7137): 1052–1057.
9. Kilgore ML, Steindel SJ and Smith JA. Evaluating Stat Testing Option Options in an Academic Health Centre: therapeutic tumarcound time and staff satisfaction. Clin Chem 1998,44:1597-1603.
10. Rainey PM. Out come Assement for point of care testing (Editorial). Clin Chem 1998;44:1595-6.
11. van Heyningen C, Watson ID and Morrice AE. Point of Care Testing Outcomes in an Emergency Department Letter). Clin Chem 1998;45:437-8.
12. Arnason T, Wells PS, Forster AJ. Appropriateness of diagnostic strategies for evaluating suspected venous thromboembolism. Thromb Haemost. 2007 Feb;97(2):195-201.
13. Knudsen AS, Den Nationale kardiologiske Behandingsv ejledning 2010. http://www.cardio.dk
14. Renaud B, Maison P, Ngako A, Cunin P, Santin A, Hervé J et al.Impact of point-of-care testing in the emergency department evaluation and treatment of patients with suspected acute coronary syndromes. Acad Emerg Med. 2008;15(3):216-24.
15. Singer AJ, Viccellio P, Thode HC Jr, Bock JL, Henry MC Introduction of a stat laboratory reduces emergency department length of stay. Acad Emerg Med. 2008 Apr;15(4):324-8.

AUTHOR AFFILIATION:

Memon N. Illahi *(Corresponding Author)*
Department of Acute Medicine
East Kent Hospitals University NHS Foundation Trust
Kent and Canterbury Hospital
Canterbury
Kent CT1 3NG
E-mail: Memon.Illahi@ekht.nhs.uk

Ruth Lapworth
Department of Clinical Biochemistry
East Kent Hospitals University NHS Foundation Trust (EKHUFT)
William Harvey Hospital
Kennington Road, Willesborough, Ashford
Kent, TN24 0LZ.

Philip Bates
Department of Clinical Biochemistry
East Kent Hospitals University NHS Foundation Trust
Kent & Canterbury Hospital, Canterbury
Kent CT1 3NG .