Original Article

Phlebotomy Tube Dealing and Test Ordering Pattern: An Experience

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ABSTRACT

Objective: To describe filling patterns and associated transcriptional aspects in phlebotomy tubes received at PNS Rahat laboratory.

Material and Methods: This descriptive study was carried out from November 2006 to August 2007 at Department of Pathology, PNS Rahat, Karachi. Phlebotomy related data was collected from various blood collection tubes and associated request/authorization forms from our in door departments including wards, intensive care units and emergency. Phlebotomy tube filling pattern, presence of clinical details/information on lab request Performa, category of doctor signing/authorizing requests, combined phlebotomy error rate from different wards, and combined phlebotomy error rate in urgent and routine requests were noted.

Results: Inappropriate filling was demonstrated in almost half of the collection tubes examined. Only 14 % of the requests actually showed reasons for request. Majority (42.3 %) did not have any mention of clinical details. Almost 69 % of requests were signed by an indirectly concerned doctor. Percentage wise combined phlebotomy error rate possibility from different departments was demonstrated at a maximum from emergency (56.9 %) followed by different wards (49.2 %) and intensive care units (27.3 %). Similarly, percentage
wise combined phlebotomy error rate possibility was higher in urgent (48.1 %) than routine investigations (34.2 %).

**Conclusion:** Phlebotomy related errors constitute a major burden in our hospitals. The errors increase with urgent and non-professional workers dealing with phlebotomy. A motivated and educated approach is required to improve phlebotomy practices in our medical set ups. (Rawal Med J 2008;33:62-66).

**Keywords:** Phlebotomy, pre-analytical errors, laboratory quality.

**INTRODUCTION**

Laboratory errors can be an important source of erroneous medical decisions with adverse outcomes for patient community, health care service managers and the laboratory staff.¹ These errors are classified as pre-analytical, analytical and post-analytical.² The main causes of these errors range from transcriptional to incorrect specimen collection to transportation and storage related mechanisms.³ The laboratory provided data is converted into evidence for action for various crucial health care decisions.⁴,⁵ However, chain of sequence involved in the overall pre-analytical chain suggests many problems.⁶ Last few years have seen incorporation of various collection tubes for phlebotomy, like Sodium fluoride + EDTA bottles being used for glucose preservation and citrated bottles for coagulation profiles.⁷ This improves the quality of storage in order to avoid pre-analytical errors, though at the cost of higher health care budgets.⁸ While incorporation of these different color topped tubes into the routine collection, storage and analysis sequences are quite desirable, their proper use requires exact knowledge, practice and motivation. Thus, it becomes more pertinent to understand the minor errors during phlebotomy collection which can be converted into major
errors in decision making.\textsuperscript{9} The aim of this study was to assess various problems associated with transcriptional aspects and phlebotomy tube filling patterns in our hospital.

\section*{MATERIALS AND METHODS}

This study was carried out in Department of Pathology, PNS Rahat, Karachi between November 2006 to August 2007. We studied various blood collection tubes along with their lab request forms from our in-door departments including wards, intensive care units and emergency. Blood tubes from out door patients were excluded from the study. The data collection procedure involved review of blood samples on a non-probability convenience basis received between morning hours (08:00 to 14:00 hours) and evening hours (17:00 to 24:00 hours) from in-door subjects. The sample collection days constituted only two days in a week. A total of 5245 blood collection tubes were screened. Four types of phlebotomy tubes were included in the study: blood complete picture (n=2193), ESR (n=1086), coagulation (n=445) and glucose bottles (n=1521). The following parameters were selected and defined were as under.

1. \textbf{Phlebotomy tube filling pattern:} Filling pattern of phlebotomy tube in all collection tubes was studied by the help of a scale. The arrow mark on phlebotomy tube meant 100 \% satisfactory filling. The tube was demarcated into five equal segments above and below the arrow or line for satisfactory filling. Each segment corresponded to 20\%. Following classifications were considered: Adequately filled, overfilled if 20 \% extra filling of tube, under filled if 20-40 \% under filled and markedly under filled if > 40 \% under filled.

2. \textbf{Presence of clinical details/information on request forms:} Based upon clinical information provided, the requests were categorized into following:

Only name of disease mentioned, actual reasons for requesting analysis clearly mentioned or
nothing mentioned

3. **Category of doctor signing/authorizing requests:** There were three categories of doctors signing lab requests: signature by medical officer incharge of the ward, where different categories of patient may be admitted, signature of medical officer in charge of the case, who is actually responsible for various patient management decisions and signature by a non-concerned doctor, like medical officer on emergency duty, who is not at all linked to the concerned patient.

During the course of study two more benchmarks were added to know the possibility of error rate from different departments and among investigations advised with an urgent label or routine. These were applied on a sample size of last 1236 samples.

4. **Combined phlebotomy error rate from different wards:** This was defined as a result generated upon an inadequately filled phlebotomy tube sample. Results were categorized into following outcomes: combined phlebotomy error more possible and combined phlebotomy error less possible.

5. **Combined phlebotomy error rate in urgent and routine requests:** Requests being labeled urgent and signed by any doctor were considered urgent, others were considered routine. Combined phlebotomy error rate were the measured in both types of requests.

**Statistical analysis** was performed using SPSS-version 15.

**RESULTS**

Out of a total of 5245 blood collection tubes considered suitable for analysis, 3844 were from wards, 858 were from emergency and 523 from intensive care unit. Almost half of the
collection tubes demonstrated inappropriate filling (fig 1). Only 14% of the requests actually showed reasons for request (fig 2). An indirectly concerned doctor signed and authorized 69% of requests (fig 3). The possibility of combined phlebotomy error rate was less likely in ICU (fig 4). Urgently requested investigations showed higher percentage of the possibility of combined phlebotomy error rate (fig 5). The maximum combined phlebotomy error rate possibility was recorded in blood complete picture collection tubes, while the minimum was from coagulation tubes (fig 6).

Fig 1: Phlebotomy tube filling pattern in our collected sample (n=5245).
Fig 2. Data categorization as per clinical information provided by the clinicians (n=5245).

Fig 3. Request authorization by various categories of doctors (n=5245).
Fig 4. Combined phlebotomy error rate possibility from different departments (n=1236).

Fig 5. Combined phlebotomy error rate possibility in urgent vs routine requests (n=1236).
DISCUSSION

We found that almost 50% of phlebotomy tubes were inappropriately filled. One very significant observation from this study was that most of the under-filling and over-filling of collection tubes had been associated with emergency department. This normally is the place where most of sensitive and sometime lives saving initial patient management decisions take place. Reasons to these poorly adopted phlebotomy practices could include lack of awareness, motivation and possibly excessive workload. Many other studies have shown similar results.⁰¹ This probably has been the real reason that phlebotomy has been considered as a separate area for improvement for medical technicians in the developed countries.¹¹
These problems are comparatively rarer in western societies on account of their early incorporation of concepts like “Total Quality Management” which deals with all details of pre-analytical aspects.\textsuperscript{12}

Most of the test requests were authorized by an indirectly concerned doctor who was not in charge of the particular case, as reported earlier.\textsuperscript{13} The solution to this may be the routine incorporation of laboratory information in the management system, where laboratory staff can easily access clinical information pertaining to a particular patient.\textsuperscript{14} The error rates were comparatively lower in coagulation and ESR tubes than glucose and Blood CP bottles. This may be because of better understanding of coagulation and ESR parameters, or perhaps the more strict measures taken by laboratory staff and by the fact that a small blood volume may be sufficient for blood complete picture analysis.\textsuperscript{10}

The limitations of the study include: First, most of the phlebotomy staff in various departments were not formally kept unaware of the study. Thus “Hawthorne effect” may result in an overall enhanced performance.\textsuperscript{19} Secondly, the intra-technician variability in recording various details may result in some variability. However, also those included in data recording were formally educated regarding data collection for this particular study. The clinical implications associated with the study are very practical. First, the study addresses the basic and routine practical problems encountered between the clinician and laboratory staff. Second, the study highlights the need for improving the phlebotomy practices in our hospitals identifying target areas for hospital management for reducing hospital budgets related to errors. Lastly, a question must be asked to the medical readers including clinicians and laboratories about the requirement of clinical information added to laboratory requests and a consensus then must be made and implemented in our hospital set ups.
REFERENCES


