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ESTIMATING THE RATE OF REJECTED SPECIMENS RECEIVED IN HEMATOLOGY LABORATORY STRATIFIED BY AREA OF COLLECTION AND REASON OF REJECTION

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ABSTRACT

The aim of this study was to examine the rate of rejection of samples collected from different locations in hospital and the reason for the rejection. A retrospective study was conducted at the Amiri Hospital, Kuwait during a 12 month period from January 1 2015 to December 31 2015. Data were retrieved from the laboratory records. A total of 263,276 samples which had been collected across 21 locations were included in the study. Of these 2,467 were rejected, giving an overall rejection rate across the hospital of 0.94%. Rejection was higher in the casualty department compared to in/outpatient locations. The highest rejection rates were for samples collected in the outpatients department (2.42%), ward 6 (1.84%) and yellow CCU (1.71%). The most common reasons for rejection of laboratory samples across the majority of locations were hemolysed samples (51.2%), clotted coagulation profile samples (14.3%) and clotted complete blood count samples (12.2%). Hemolysis and clotting of samples are the most common reasons for sample rejection in our laboratory. Regular training and updates for clinical staff should improve sample collection techniques and result in lower rates of sample rejection by the hematology laboratory.

KEYWORDS: Hematology, Rejection, Specimen, Laboratory

INTRODUCTION

Within the hospital environment, hematology specimens provide important information for disease diagnosis and patient management. If there is any suspicion that the integrity of test results may be compromised, for example due to poor sample condition or poorly labelled specimen tubes, the laboratory will reject the sample to ensure that patient management is not affected by an inaccurate test result.

Within the Amiri Hospital, the hematology laboratory follows a set of guidelines which define whether a sample should be accepted. Rejection of specimens or test results may occur prior to, during or after analysis. Pre-analytical errors leading to rejection include specimens that have been collected in an incorrect or expired tube, incorrectly labeled tubes (for example error in the patient name or lack of a physician identifier) and samples that have clotted. Analytical errors may include incomplete test runs, whilst post-analytical errors include identified miss-match between blood group of sample and blood group in patient record.

OBJECTIVES OF THE STUDY

The aim of this study was to examine the rate of rejection of samples collected from different locations in hospital and the reason for the rejection.

METHODS

A retrospective study was conducted at the central Hematology Laboratory at the Amiri Hospital, Kuwait, for a twelve-month period from January 1, 2015 to December 31, 2015. Data were retrieved from the laboratory records. Reasons for rejection across 20 locations were examined. In our laboratory, samples may be rejected for any of the following reasons:

- Clotted sample
- Error on patient's name
- Discrepancy between sample and patient
- Hemolysed sample
- Wrong data entry
- No or incorrect ID
- Insufficient sample
- Improper ratio
- Maldistribution of reports
- Diluted sample
- Insufficient clinical data
- No physician stamp
- Double requests
- Labels switched between patients
- Two results released for two machines
- No request
- Incomplete test run
- No sample received
- Unlabelled sample
- Delayed authentication
- Double samples
- Incorrect blood group
- Result discrepancy
- Mislabeled sample

- Writing mistake
- Incorrect container
- Wrong blood group in civil identification
- Wrong barcode on sample
- No address
- Expired tube
- Tube and cover switched
- Inadequate identification
- Laboratory identification system problem

RESULTS AND DISCUSSIONS

The total numbers of hematology samples as well as the number of rejected samples were collected. The areas of collection as well as the reason of rejection were recorded and the results were as follows.

A total of 263,276 samples were included in the study. Of these 129,651 had been collected in the casualty department and the remaining 133,625 sample had been collected across 20 locations were included in the study. A total of 2,467 were rejected, giving an overall rejection rate across the hospital of 0.94%. The casualty department had a higher rejection rate (1.07%) compared to the inpatient and outpatient departments (0.81%). For individual locations, the highest rejection rates were for samples that were collected in the outpatients department (2.42%), followed by ward 6 (1.84%) and yellow CCU (1.71%). The lowest rejection rates were for samples collected from wards 4 (0.45%) and ward 16 (0.32%).

The most common reasons for rejection of laboratory samples across the majority of locations were hemolysed samples (51.2%), clotted coagulation profile samples (14.3%) and clotted complete blood count samples (12.2%). Hemolysed samples were particularly frequent in samples collected from adults in the casualty department (males, 69%; females, 72%) compared to all other locations (28.2%). In contrast, clotted samples were more common in the inpatient/outpatient locations (16.7%, clotted complete blood count samples; 21.6% clotted coagulation samples) compared to the casualty department (7.9% for both clotted complete blood count and clotted coagulation samples). Other reasons for rejection included incorrect ratio for testing coagulation profile (4.7%), insufficient sample for complete blood count (2.1%), error on patient's name (2.1%), discrepancy between sample and patient (1.9%), and no or incorrect ID (1.4%). The remaining reasons for rejection detailed above were not commonly experienced. In general, we did not observe major differences in the types of error from different locations. Interestingly, there were differences in the types of errors observed in samples collected from pediatric casualties compared to those collected from adult casualties. Samples from pediatric casualties were more likely to be associated with clotting errors (49.1%, clotted complete blood count samples; 21.8% clotted coagulation samples) compared to adult samples (6.2%, clotted complete blood count samples; 7.3% clotted coagulation samples), with clotted complete blood count samples the most common error for pediatric casualty patients. In contrast, whilst the most common error in adult samples was hemolysed samples (70.9%), no pediatric samples were associated with this error type. A detailed tabular representation of the study results has been prepared in Table 1.

Table 1: Tabular Representation of the Study Results

	MCA n (%)	FCAn (%)	PCA n (%)	W01 n (%)	W02 n (%)	W04 n (%)	W05 n (%)	W06 n (%)	W07 n (%)	W08n (%)	W09n (%)	W10n (%)	W11n (%)	W12n (%)	W14n (%)	W15n (%)	W16n (%)	W17 n (%)	ICUn (%)	YELLOWn (%)	BLUE n (%)	OPD n (%)	OTn (%)	Total
N Samples	63739	57551	8361	7049	7213	7483	7161	4518	10210	10049	11024	12083	9800	7926	1884	1755	3081	4585	14753	5510	5398	1320	841	263276
N Rejected	541	788	55	44	39	34	42	83	72	78	80	122	62	64	11	12	10	54	90	94	50	32	10	2467
% Rejected	0.85	1.37	0.66	0.62	0.54	0.45	0.59	1.84	0.71	0.78	0.73	1.01	0.63	0.81	0.58	0.68	0.32	1.18	0.61	1.71	0.93	2.42	1.15	0.94
1	34 (6.3)	48 (6.1)	27 (49.1)	5 (11)	7 (18)	5 (15)	5 (12)	7 (8.4)	11 (15)	20 (26)	22 (28)	29 (24)	18 (29)	18 (28)	3 (27)	4 (33)	1 (10)	6 (11)	10 (11)	7 (7.4)	7 (14)	6 (19)		300 (12.2)
2	33 (6.1)	64 (8.1)	12 (21.8)	11 (25)	6 (15)	9 (26)	7 (17)	18 (21.7)	12 (17)	24 (31)	22 (28)	34 (28)	13 (21)	15 (23)	5 (46)	6 (50)	1 (10)	7 (13)	26 (29)	15 (16)	10 (20)	4 (13)	1 (10)	355 (14.3)
3	13 (2.4)	15 (1.9)	1 (1.8)	1 (2.3)			1 (2.4)		1 (1.4)	1 (1.3)		2 (1.6)	1 (1.6)	1 (1.6)	1 (9.1)					1 (1.1)	1 (2.0)	2 (6.2)	1 (10)	43 (1.7)
4	11 (2.0)	13 (1.6)	2 (3.6)	1 (2.3)				45 (54.2)	16 (22)	15 (19)	16 (20)	19 (19)	4 (6.5) 13 (21)	19 (30)	1 (9.1)		1 (10)	23 (43)	2 (2.2) 26 (29)	1 (1.1) 57 (61)	24 (48)	1 (3.1) 12 (38)	1 (10) 2 (20)	36 (1.5) 1263 (51.2)
5	372 (69)	570 (72)		6 (14)	11 (28)	8 (24)	7 (17)									1 (8.3)								1 (0.04)
6																								
7	8 (1.5)	10 (1.3)	2 (3.6)		1 (2.6)		2 (4.8)				1 (1.3)	1 (0.8)	1 (1.6)						2 (2.2)	2 (2.1)	1 (2.0)	LAB		16 (0.6)
8																						LAB		0
9	7 (1.3)	19 (2.4)	3 (5.5)	7 (16)	3 (7.7)	4 (12)	2 (4.8)		9 (13)	6 (7.7)	11 (14)	14 (11)	2 (3.2)	3 (4.7)		1 (8.3)	1 (10)	7 (13)	3 (3.3)	1 (1.1)				103 (4.2)
10	36 (6.7)	25 (3.2)	4 (7.3)	11 (25)	7 (18)	4 (12)	16 (38)	9 (10.8)	16 (16)	9 (12)	7 (8.8)	16 (13)	4 (6.5)	5 (7.8)			5 (50)	10 (19)	11 (12)	4 (4.3)	4 (8.0)	5 (16)	30 (30)	211 (8.6)
11																						LAB		0
12	1 (0.2)																							0
13	4 (0.7)		1 (1.8)		3 (7.7)		1 (2.4)		1 (1.4)		1 (1.3)	1 (0.8)			1 (9.1)					1 (1.1)		1 (3.1)	1 (10)	16 (0.6)
14	7 (1.3)	8 (1.0)	1 (1.8)	1 (2.3)		1 (2.9)			1 (1.4)			1 (0.8)		2 (3.1)					5 (5.6)	1 (1.1)	1 (2.0)			29 (1.1)
15						1 (2.9)																		1 (0.04)
16																			2 (2.2)					2 (0.08)
17																			1 (1.1)					1 (0.04)
18		1 (0.1)				1 (2.9)							1 (1.6)											3 (0.12)
19													1 (1.6)									LAB		
20	7 (1.3)	7 (0.9)					1 (2.4)	3 (3.6)	1 (1.4)	1 (1.3)		4 (3.3)	3 (4.8)	1			1 (10)	1 (1.9)		3 (3.3)	1 (2.0)			34 (1.4)
21	4 (0.7)	5 (0.6)						1 (1.2)		1 (1.3)										1 (1.1)	1 (2.0)		1 (10)	14 (0.6)
22				1 (2.3)																				
23	2 (0.4)																							1 (0.04)
24																						KCB		0
25			1 (1.8)							1 (1.3)									1 (1.1)					2 (0.2)
26	2 (0.4)				1 (2.6)				1 (1.4)															2 (0.2)
27																						KCB		0
28		1 (0.1)	1 (1.8)			1 (2.9)			1 (1.4)				1 (1.6)									1 (3.1)		4 (0.4)
29												1 (0.8)												1 (0.1)
30																						LAB		0
31		1 (0.1)																						0
32		1 (0.1)																						0
33									1 (1.4)										1 (1.1)					2 (0.2)
34									1 (1.4)															1 (0.1)
35																						LAB		0

Error types: 1. Clotted sample (CBC). 2. Clotted Sample (COAG). 3. Error on patient's name. 4. Discrepancy between sample and patient. 5. Hemolysed sample (COAG). 6. Wrong data entry. 7. No or incorrect ID. 8. Wrong data entry 9. Insufficient sample (CBC). 10. Improper ratio (COAG). 11. Misdistribution of reports. 12. Diluted sample. 13. Insufficient clinical data. 14. No physician stamp. 15. Double requests. 16. Labels switched between patients. 17. Two results released for two machines. 18. No request. 19. Incomplete test run. 20. No sample received. 21. Unlabelled sample. 22. Delayed authentication. 23. Double samples. 24. Incorrect blood group. 25. Result discrepancy. 26. Mislabeled sample. 27. Writing mistake. 28. Incorrect container. 29. Wrong blood group in civil identification. 30. Wrong barcode on sample. 31. No address. 32. Expired tube. 33. Tube and cover switched. 34. Inadequate identification. 35. Laboratory identification system problem. CBC – Complete blood count; COAG – Coagulation profile; W – Ward; ICU – Intensive care unit; OPD – Outpatient department; OT – Operation theatre

DISCUSSIONS

Identifying common reasons for sample rejection by the hematology laboratory is a key step to improving quality control and therefore ensuring that patient diagnosis and management is informed by accurate and reliable test results.

In this retrospective study we detected an overall rejection rate of 0.94%. Previous studies have reported rejection rates ranging from 0.71% to 6%, whilst the College of American Pathologists Q-Probe study of 453 laboratories reported a median rate of 0.35% (Stark, et al. 2007; Dikmen, et al. 2015; Zarbo, et al. 2002; Jones, et al. 1997). Across the hospital rejection rates ranged from 0.45% to 2.42%. More errors were associated with samples from the emergency department than those from inpatient and outpatient departments. This is in line with other studies which have suggested that higher rejection rates are found for samples collected in the emergency department and from inpatients (Stark, et al. 2007; Dikmen, et al. 2015). This is thought to be associated with the increased severity and seriousness of the diseases and co morbidities of inpatients and those admitted to the ED, which may compromise sample quality compared to patients in an outpatient environment. Notably however, the highest rejection rate from an individual location was observed from the outpatient department. The high rate of sample rejection from the outpatient department in our hospital may be related to staff or technical factors and these require further investigation.

We found that the large majority of sample rejections were a result of either hemolysis or clotting of the sample prior to its arrival in the laboratory. This is in line with a study conducted in Turkey, which observed clotting as the most common reason for rejection of samples from their laboratory (Dikmen, et al. 2015), and a report by Jones et al. (1997) which found that pre-analytical errors accounted for 25-50% of sample errors (Jones, et al. 1997). Interestingly, adult samples were more likely to be associated with hemolysis, whilst paediatric samples were more likely to be associated with clotting errors. Both hemolysis and clotting of samples are generally caused by errors during sample collection. Hemolysismay be caused by a number of collection errors including mixing additive tubes too vigorously or using rough handling during transport, drawing blood from a vein that has a hematoma, pulling back the plunger on a syringe too quickly, using a needle with too small a bore for the venepuncture, using too large a tube when using a small diameter butterfly needle, frothing of the blood caused by improper fit of the needle on a syringe, forcing the blood from a syringe into an evacuated tube, excessive fist clinching or leaving the tourniquet on for longer than one minute. Sample clotting most commonly occurs when sample tubes are not adequately mixed immediately after collection, thereby resulting in inadequate mixing of the sample with the anti-coagulant. Such errors may result due to inexperience of staff or lack of attention to sample collection by staff, suggesting that additional training or regular updates may improve the rate of sample rejection.

CONCLUSIONS

In summary, the rate of sample rejection from our hematology laboratory was in line with that reported in previous studies. The types of error recorded were consistent across the various hospital locations and were most frequently a result of user error leading to sample hemolytic or clotting. Our study suggests that hospital staff would benefit from implementation of regular training with respect to sample collection in order to reduce the rate of samples rejected by the hematology laboratory.

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