Analysis of test requisitions and optimum utilization of routine laboratory investigation in a tertiary care teaching hospital

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ABSTRACT

Background: Overutilization of investigations, leads not only to excessive burden on the laboratory but also gives rise to a multitude of problems in patient management. Practice of evidence based laboratory medicine and awareness of cost effectiveness of tests amongst prescribing clinicians is hence of paramount importance to address this problem.

Aim: The aim of this study is to analyse the prescribed requisitions for common hematological and biochemical tests and determine the prevalence of the “inappropriate” and “avoidable” tests.

Materials and Methods: We conducted a retrospective cross-sectional study on hospital records of 150 male patients admitted to acute medical and surgical wards from 01 Dec 2015 to 29 Feb 2016 at a tertiary care teaching hospital located in North India. The tests requisitions for routine biochemical and hematological investigations during period of admission were analysed and categorized into three categories by a panel of three doctors: appropriate, inappropriate and avoidable.

Results: In our study we analysed 10236 requisitions of common biochemical and hematological tests ordered for 150 admitted male patients and found that only 50.4% tests were clinically “appropriate”. 22.4% of the total tests performed were “inappropriate” and hence were wasteful. 27.2% of tests were categorized as “avoidable”.

Conclusion: This study provides a detailed insight into the investigation requisition pattern for most common hematological and biochemical investigations which form a major part of workload in a clinical laboratory. The study shows that a considerable number of investigations are inappropriate and do not contribute to patient management in any manner. These tests are a drain on the resources and hence must be eliminated by formulation of strict guidelines and protocols. On the other hands there are some avoidable test orders which arise from inability of the clinicians to prescribe tests in accordance to pretest probabilities and evidence based practice. These avoidable tests can be reduced by interactive education of the clinicians.

Key-Words: laboratory investigation, tertiary care hospital, patient management, inappropriate, avoidable, biochemical, hematological.

INTRODUCTION

The science of laboratory medicine has come a long way from manual methods to fully automated processes. This has led not only to increased accuracy and precision in test results but also has caused a significant reduction in the turnaround time. These advancements have however caused a paradoxical increase in workload on the laboratory (1) due to increased availability of the enhanced test panels and increased frequency of repeat testing. Hence this problem is chiefly faced in the ‘resourceful’ scenario where there is easy access to diagnostic services. The problem of overutilization of laboratory services is global (2,3) and it has been concluded that approximately upto 30% of laboratory testing is unnecessary and wasteful (4).

Beside the financial burden, overutilization of laboratory resources also causes a serious compromise on the quality of test reports due to wear and tear of equipments and fatigue of the laboratory staff leading to human errors. With an aim to determine the prevalence of inappropriate or avoidable testing in our 750 bedded tertiary care teaching hospital, we conducted a cross-sectional study involving 150 hospitalised male patients.

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MATERIAL AND METHODS

A retrospective cross-sectional study was conducted from 01 Dec 2015 to 29 Feb 2016 at a tertiary care teaching hospital located in North India. 150 male patients admitted to acute medical and surgical wards were included in the study. Data was collected from medical records of the patients. Following patients were excluded from the study:

i. Patients admitted with a definitive diagnosis or patients admitted for specific treatment or elective surgeries

ii. Patients admitted for less than 48 hrs

iii. Patients with incomplete medical records

A test was considered as “appropriate” if it was used for:

i. Diagnosis, monitoring disease or therapy

ii. Exclusion of a differential diagnosis

iii. For screening

iv. For diagnosis of comorbid diseases.

A test was defined as being “inappropriate” if:

i. The results were not instrumental in guiding further investigation or treatment.

ii. The results were not vital for monitoring therapy or prognostication of the disease.

iii. If a test which has been ordered in Emergency dept was ordered again when the patient reached the ward; the repeat test was considered inappropriate.

A test was defined as being “avoidable” if:

i. An appropriate test is ordered but with increased frequency

ii. When the test results did not supplement or enhance information provided by other test results

iii. When there was a better alternative test available for the clinical condition

iv. If repeated testing of an analyte yielded normal result; the repeat testing is considered avoidable.

The medical records were diligently scrutinized by a panel of three doctors. The investigations ordered for each patient were serially noted for each day after admission as was endorsed in the case sheet. The investigations ordered were categorized as appropriate, inappropriate and avoidable based on the aforementioned criteria after approval of at least two out of three members of the panel. The laboratory investigations included for analysis in the study were: hemoglobin, total leucocyte count (TLC), differential leucocyte count (DLC), platelet count, ESR, glucose, fractionated bilirubin, AST, ALT, ALP, urea, creatinine, uric acid, sodium, potassium, calcium, phosphorus, total protein, albumin, globulin and urine routine examination. A descriptive analysis was conducted on the data extracted from the medical records of the patients.

RESULTS

150 male patients from acute medical and acute surgical ward were included in the study with age of the patient ranging from 17 to 66 yrs. The average length of stay for the patients included in the study was 7.6 days. The data revealed that there was an average requisition of 8.9 tests/day/patient. A total of 10,236 test requisitions were made for these patients. Out of these tests 50.4% tests were judged to be clinically “appropriate” as per aforementioned criteria. 22.4% of the total tests performed were “inappropriate” while 27.2% of tests were “avoidable”.

Hematological investigations like Hb, TLC and DLC were overall most commonly ordered tests. Data of DLC tests performed revealed highest “inappropriate” use (33.3%). Plasma glucose was most commonly used biochemical tests; however 64.9% of the test requisitions were made for screening, diagnosis or monitoring of the disease and was found to be “appropriate”. Serum electrolytes (sodium and potassium) were also commonly ordered tests which included 34.7-35.2% “avoidable” testing mainly due to increased frequency of testing and retesting without significant clinical indication in a previously normal tested patient. Liver function test including serum bilirubin and transaminases were found to be most overutilised tests with 44.4% “inappropriate” serum bilirubin tests. Serum AST and ALT had 24.3-24.9% inappropriate testing primarily attributable to panel testing. 42.1-43.6% of ALT and AST tests were “avoidable”. 38.9% of routine urine examinations were found to be “inappropriate” while 31.9% were “avoidable” testings (Table-1).
TABLE 1: Investigation results of appropriate, inappropriate and avoidable tests.

<table>
<thead>
<tr>
<th>Test</th>
<th>No of requisition</th>
<th>No of appropriate tests</th>
<th>Inappropriate tests</th>
<th>Avoidable tests</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>(%)</td>
<td>Number (%)</td>
<td>Number (%)</td>
</tr>
<tr>
<td>Hemoglobin</td>
<td>932</td>
<td>514 (55.2)</td>
<td>144 (15.5)</td>
<td>274 (29.4)</td>
</tr>
<tr>
<td>TLC</td>
<td>911</td>
<td>499 (54.8)</td>
<td>181 (19.9)</td>
<td>231 (25.4)</td>
</tr>
<tr>
<td>DLC</td>
<td>904</td>
<td>358 (39.6)</td>
<td>301 (33.3)</td>
<td>245 (27.1)</td>
</tr>
<tr>
<td>Platelet count</td>
<td>867</td>
<td>404 (46.6)</td>
<td>203 (23.4)</td>
<td>260 (29.9)</td>
</tr>
<tr>
<td>ESR</td>
<td>102</td>
<td>33 (32.4)</td>
<td>48 (47.1)</td>
<td>21 (20.6)</td>
</tr>
<tr>
<td>PT/INR</td>
<td>241</td>
<td>172 (71.4)</td>
<td>56 (23.2)</td>
<td>13 (5.4)</td>
</tr>
<tr>
<td>Plasma Glucose</td>
<td>774</td>
<td>502 (64.9)</td>
<td>112 (14.5)</td>
<td>160 (20.7)</td>
</tr>
<tr>
<td>S. Total bilirubin</td>
<td>583</td>
<td>241 (41.3)</td>
<td>259 (44.4)</td>
<td>83 (14.2)</td>
</tr>
<tr>
<td>S. Direct bilirubin</td>
<td>279</td>
<td>168 (60.2)</td>
<td>96 (34.4)</td>
<td>15 (5.3)</td>
</tr>
<tr>
<td>S. AST</td>
<td>539</td>
<td>178 (33.1)</td>
<td>134 (24.9)</td>
<td>227 (42.1)</td>
</tr>
<tr>
<td>S. ALT</td>
<td>534</td>
<td>171 (32)</td>
<td>130 (24.3)</td>
<td>233 (43.6)</td>
</tr>
<tr>
<td>S. ALP</td>
<td>59</td>
<td>37 (62.7)</td>
<td>11 (18.6)</td>
<td>11 (18.6)</td>
</tr>
<tr>
<td>S. Total protein</td>
<td>212</td>
<td>144 (67.9)</td>
<td>63 (29.7)</td>
<td>05 (2.4)</td>
</tr>
<tr>
<td>S. Albumin</td>
<td>199</td>
<td>123 (61.8)</td>
<td>34 (17.1)</td>
<td>42 (21.1)</td>
</tr>
<tr>
<td>S. Urea</td>
<td>502</td>
<td>275 (54.8)</td>
<td>42 (8.4)</td>
<td>185 (36.9)</td>
</tr>
<tr>
<td>S. Creatinine</td>
<td>504</td>
<td>278 (55.2)</td>
<td>46 (9.1)</td>
<td>180 (35.7)</td>
</tr>
<tr>
<td>S. Uric acid</td>
<td>104</td>
<td>67 (64.4)</td>
<td>21 (20.2)</td>
<td>16 (15.4)</td>
</tr>
<tr>
<td>S. Sodium</td>
<td>593</td>
<td>289 (48.7)</td>
<td>98 (16.5)</td>
<td>206 (34.7)</td>
</tr>
<tr>
<td>S. Potassium</td>
<td>596</td>
<td>312 (52.3)</td>
<td>74 (12.4)</td>
<td>210 (35.2)</td>
</tr>
<tr>
<td>S. Calcium</td>
<td>269</td>
<td>198 (73.6)</td>
<td>54 (20.1)</td>
<td>17 (6.3)</td>
</tr>
<tr>
<td>S. Phosphorus</td>
<td>244</td>
<td>112 (45.9)</td>
<td>69 (28.2)</td>
<td>63 (25.8)</td>
</tr>
<tr>
<td>Urine routine exam</td>
<td>288</td>
<td>84 (29.2)</td>
<td>112 (38.9)</td>
<td>92 (31.9)</td>
</tr>
<tr>
<td>TOTAL</td>
<td>10236</td>
<td>5159 (50.4)</td>
<td>2288 (22.4)</td>
<td>2789 (27.2)</td>
</tr>
</tbody>
</table>

DISCUSSION

Several studies have been conducted worldwide to assess the overutilization of laboratory investigations and they have varied figures for inappropriate testing ranging from 30%–65% (4–7). In our study we have categorized the overuse of test as “inappropriate” and “avoidable”. The “inappropriate” tests are not justifiable and a thorough clinical history and examination can help reduce their number. Our institute being a teaching hospital has significant number of junior resident doctors who are not experienced enough to stringently practice evidence based medicine can be guided by their faculty to cut down “avoidable” tests by logical reasoning.

Avoidance of routine usage of protocol testing and extended panel of tests would also cut down unnecessary usage of laboratory facility. Panel testing may be modified to sequential testing rather than parallel testing to reduce number of tests. Sequential testing refers to a model where result of particular test decides subsequent tests to be performed vis a vis parallel testing model where all the tests are performed at once (9). The unnecessary repeat testing may itself trigger a vicious cycle of further irrelevant testing triggered by false positive tests. This results from the fact that if a physiologically normal individual undergoes ten unnecessary tests, there is 40% chance that there will be at least one false positive result (10).

Several studies have concluded that use of certain tests should be limited in routine clinical practice to avoid burden on laboratory services. These use of serum amylase for diagnosis of acute pancreatitis when serum lipase is available (11,12) and preferred use of ALT over AST in assessment of liver damage (13). It has been noted that the teaching hospitals have higher load of irrelevant testing possibly because of overprescribing of tests by junior resident doctors. Hence sensitization of junior doctors towards practice of evidence based laboratory medicine is very important. The lack of...
insight into the physiological variation in analytes, diurnal variations etc by less experienced clinicians may trigger a cascade of unnecessary further tests. Also they usually overlook the fact that 5% of test reports in normal individuals may fall out of reference range (14). The burden of unnecessary testing not only causes serious financial burden on the hospital resources but may also cause several problems like mental agony to patient due to false positive (15) and even iatrogenic anemia in critically ill patients (16).

CONCLUSION
In our study on 150 male patients admitted to acute medical and surgical wards in a tertiary care teaching hospital we analysed 10236 requisitions of common biochemical and hematological tests concluded that there are 22.4% inappropriate tests which are not contributing to diagnosis or monitoring of disease and hence are absolutely wasteful. Stringent guidelines may be made to thus eliminate these tests. Ours being a teaching hospital with trainee and junior doctors also bears load of 27.2% avoidable tests. This category of overuse can only be reduced by repeated interactive sessions between laboratory and clinical side, feedbacks and audits (17,18). Also the clinicians must be made aware of the tests costs so that they use the prescription of tests more judiciously.

REFERENCES