IMPROVEMENT IN THE PATTERN OF ADVICE OF INVESTIGATIONS FOLLOWING RATIONALIZATION CAMPAIGN

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ABSTRACT

Objective: To assess the magnitude of change in advising pattern of laboratory and radiological investigations during and after campaign emphasizing rational use of these tests.

Study design: Comparative cross sectional study.

Place and Duration: Combined Military Hospital Peshawar, Twenty seven months.

Patients and Methods The laboratory investigation analysis were Blood Glucose, Thyroid Function Tests, Liver Function Tests (LFT), Renal Function Tests (RFT) and Cardiac Markers and radiological tests were X-Rays Chest, Skull, Wrist and Plain Abdomen, Obstetric Ultra Sound (USG) and CT Scan. The awareness was done by Lectures, handouts, feedback advice on test reports and personal communications to the Medical Officers, Nursing Officers and Paramedical Staff. The data was analyzed through Quarterly Returns, records of laboratory and radiology retrieved from Hospital Information System and departmental registers.

Results: In some laboratory investigations there was a significant improvement in the advisory pattern e.g. blood glucose fasting instead of random, ALT instead of whole LFT, electrolytes not included in every RFT and abolishing of AST and LDH from cardiac marker profile and TSH only as screening test. In Radiology there was improvement in the rationality of X-Ray chest, X-Ray skull, X-Rays wrist and obstetric USG. CT scan data could not be compared because CT Scan equipment became out of order during the study. There was also reduction in expenses incurred on irrational investigations.

Conclusion: A dynamic ongoing process of awareness and realization campaign for medical professionals is required in any public sector medical institute for cultivating a culture of rational use of investigations.

Key words: evidence-based laboratory medicine, evidence–based medicine, rationality.

INTRODUCTION

Test-ordering behavior of the physicians is not influenced by the cost factors as those ordering investigations are frequently ignorant of the cost of the tests which they are ordering, both to the patient and the community[1]. Other factors leading to irrational investigations include lack of evidence based medicine (EBM), advising test profiles, clinical uncertainty, peer pressure, greater patient awareness and fear of litigation. Rational Diagnostics (RD) are in fact smart, cost-effective and patient- friendly use of laboratory and radiological investigations. It neither means use of an outdated method nor use of low-priced reagents or obsolete equipment. RD does not bar or hinder employment of new techniques. Major characteristics of RD include EBM and cost-effective use of investigations for efficient patient management. Irrational ordering of diagnostics can adversely affect the necessary and life saving investigations, besides being burden on national exchequer. Big and unjustified demand for non- specific parameters and for "all and everything" shows lack of awareness while professionals with more experience and knowledge usually request far less but specific analyses and get more useful information[2].

An excellent model of application of RD is provided by screening of thyroid dysfunction. For screening or case finding for thyroid dysfunction, a sensitive Thyroid Stimulating Hormone (TSH) assay is all that is initially required. If, however, the TSH result is abnormal, free Thyroxine (T4) and/or Triidothyronine (T3) can be carried out. In this

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example, the number of patients undergoing all three tests is reduced to almost one third or even less[3].

Radiation safety is a well-recognized issue in imaging investigations and one has to weigh between the hazardous effects of the radiations and the benefits of these investigations on patient's health management[4], but even in countries like UK at least a fifth of radiological examinations carried out in hospitals are clinically unhelpful. Royal College of Radiologist (RCR) periodically issues guidelines for radiological investigations with the aim to encourage more appropriate use of diagnostic radiology and to reduce the use of clinically unhelpful x-ray examinations. Rationalization campaigns, based on such clinical guidelines, result in reduction of unjustified investigations. In a UK study, data was collected for one year before issuing and campaigning of guidelines and 6 months after it, a reduction of 28% in radiological referrals was achieved[5]. In other randomized control trials it was shown that guideline campaigns can reduce unnecessary radiological referrals[6,7,8].

The application, therefore, of EBM in laboratory medicine and radiology is aimed to advance clinical diagnosis by researching and disseminating new knowledge, combining methods from clinical epidemiology and statistics[1]. Health Administrators, Laboratory and Radiology professionals must not leave the practice of medicine at the mercy of ignorance and should carry out full efforts in demonstrating the impact of diagnostic tests on a greater variety of clinical outcomes. They should update themselves with many of the accessible electronic and paper tools for searching for evidence[9].

In our country, with meager financial resources, especially the shrinking foreign reserves, it is all the more pertinent to advocate a rational approach to the use of diagnostic facilities in public sector. The objective of present study was, therefore, to determine the effect of a campaign on rationalization in use of Laboratory and Radiological investigative facilities, that is, more appropriate use of diagnostic services and so to reduce the use of clinically unhelpful investigations.

PATIENTS AND METHODS

The study was carried out in CMH Peshawar, and lasted for twenty seven months. It was a comparative cross sectional study in which data was analysed before, during and after extensive campaigns. Following investigations were studied.

Laboratory: Plasma Glucose Fasting (PGF), Plasma Glucose Random (PGR), Plasma Glucose two hours after Breakfast (PG 2h ABF), Oral Glucose Tolerance Test (OGTT); RFT i.e. Serum Urea, Creatinine, sodium and potassium; LFT i.e. Serum Bilirubin, ALT and alkaline phophatase (ALP); cardiac markers i.e. CK, AST, LDH, CK-MB and Troponins; TFT i.e. TSH, T4, and T3. Isolated estimations of Bilirubin, ALP, AST and LDH were excluded from the study since they may be used for some definite indications.

Radiology: X-Ray Chest, X-Ray Skull, X-Rays Wrist, X-Rays Plain Abdomen and Obstetric Ultra Sound (USG) and CT Scan.

Following campaigning modes were used:

Lectures, presentations and clinico-pathological conferences to the Medical Officers, Nursing Officers and Paramedical Staff. Handouts were distributed to the doctors to be pasted at prominent places in their clinics and wards. Rationalization of investigations was advised as comments in the interpretation of various tests e.g. advising PGF in a report of PGR. Personal communications to doctors on telephones and in meetings etc. Rational investigations were facilitated e.g. by provision of lab kits or sampling tubes.

It is important to note that no investigation once advised by the doctors was refused.

Phases of the study: The study comprised following three phases.

First Phase: Analysis of the data for a year previous to the start of campaign From 01 Aug 2006 to 31 Jul 2007.

Second Phase Campaign lasted for one year i.e. from 01 August 2007 to 31 Jul 2008.

Third Phase Analyses of data during the campaign and for three months after it i.e. 01 Aug 2008 to 31 Oct 2008.

Sources of Data:

Quarterly Returns which are compiled for each department and sent to higher authorities and records of Laboratory and Radiology retrieved from Hospital Information System and departmental registers. Cost of investigations was calculated in accordance with the government rates, which is based on sum of reagent cost, manpower and over-head expenses.

Analyses of Data:

Data was collected from the above mentioned sources for various Laboratory and Radiological tests and was dealt as following:

In HIS data was in SQL Server Database. It was converted to Microsoft Excel and then percentages were calculated.

Manual retrieval of data from hard copies was also used for manual calculation of percentages.

The breakdown of total number tests of each analyte into various categories (e.g. total glucose broken down to fasting, random and 2 h after breakfast glucose etc.) was done in percentages for ease of comparison between various phases.

Percentages were compared by Fisher' Exact Test using SPSS Ver 13.0. A value < 0.05 was taken as significant

RESULTS

As shown in Table-1 there is a steady and significant increase in PGF percentage through first, second and third phase with a corresponding decrease in PGR and PG2hABF estimations. Percentage of patients with isolated ALT estimation increased from 28 % in first phase to 37% and 44% in second and third phases, respectively (Table-2). Changing in renal function test and electrolytes are given in Table-3 and similarly cardiac markers and thyroid function tests are given in Table 4 & 5.

In Radiology investigations, there was an overall reduction of 8%. Table-6 presents the referral rates before, during and after the implementation of the campaign. There was a definite decrease in all the unnecessary x-rays examinations which led to reduced radiation exposure to the patients and radiology staff with no compromise on the investigations strategy and health of the patients. The total number of obstetric referrals was also reduced thus allowing the radiologists to improve the quality of the radiology services and dedicate more time to the referred patients. The result for CT scans could not be completed due to inadvertent fault in the equipment towards the end of second phase.

As shown in Table-7, Rs. 1.5 million in Phase II and Rs. 0.75 million in Phase III were expended less on irrational radiology and laboratory investigations.

Table I: Changes in Plasma Glucose Tests in three Phases of the study

Type	Phase I	Phase II	Phase III
Total Plasma Glucose Tests	75513	79683	18858
*FPG (%)	22169 (29)	35865 (45)	8904 (47)
*Random (%)	38988 (52)	30286 (38)	6441 (34)
@2 h ABF (%)	13760 (18)	12752 (16)	3220 (17)
OGTT (%)	581 (0.77)	685 (0.86)	265 (1.4)
OGTT for GDM (%)	15 (0.02)	95 (0.12)	28 (0.15)

Table-2: Changes in Number of Patients undergone Liver Function Tests (excluding isolated Bilirubin and Alkaline Phosphatase estimations) in three Phases of the study

	Phase I	Phase II	Phase III
Total	31065	33721	8993
All three tests (%)	22448 (72)	22570 (63)	5036 (56)
ALT alone (%)	8617 (28)	13151 (37)	3957 (44)

p < 0.001

Table-3: Changes in Number of Patients undergone Renal Function Tests and Electrolytes

	Phase I	Phase II	Phase III
Total	17260	21032	6426
Four tests i.e. urea, Creatinine and electrolytes (%)	14451(83)	14122 (67)	3362 (52)
Urea and /or creatinine Only(%)	1916 (11)	3250 (15)	1234 (19)
Electrolytes estimation only(%)	893 (5.7)	3660 (17)	1830 (28)
Abnormal Electrolyte Results (%)	310 (1.8)	1303 (6.2)	571 (8.9)

p < 0.001

Table-4: Changes in *Number of Patients* undergone *Cardiac Markers* in three Phases of the study

	Phase I	Phase II	Phase III
Total	5248	7240	1861
Three tests i.e. CK, AST and LDH (%)	852 (16)	572 (7.9)	112 (6.0)
Two tests i.e. CK & LDH (%)	1624 (31)	988 (13)	224 (12)
CK only	1499 (29)	4173 (58)	1116 (60)
CK and CK-MB (%)	1264 (24)	1480 (20)	384 (21)
Trop T (%)	9 (0.17)	27 (0.3)	25 (1.3)

$p < 0.001$

Table-5: Changes in Number of Patients undergone, Thyroid Function Tests in three Phases of the study

	Phase I	Phase II	Phase III
Total Patients	4428	4654	1148
All three tests i.e. T3, T4 and TSH (%)	2479 (56)	2091 (45)	333 (29)
T4 and TSH (%)	1373 (31)	585 (13)	298 (26)
TSH only (%)	576 (13)	1978 (42)	517 (45)

$p < 0.001$

regard by health administrators, pathologists and radiologists. The present study has clearly demonstrated that such efforts do bear fruitful

Table-6: Changes in Referral Rate of Radiological Examinations

Examination		Phase I	Phase II	Phase III	p value
X-Ray Chest-optional views	Total Chest X-Rays	29922	20371	6746	
	Optional views i.e. other than PA view (%)	984 (3.3)	592 (3.6)	152 (2.2)	< 0.001
X-ray Skull-optional views	Total Skull X-Rays	1483	1393	657	
	Optional views i.e. other than Lateral view (%)	763 (51)	571 (41)	223 (34)	< 0.001
X-ray Wrist- optional views	Total Wrist X-Rays	1064	1041	314	
	Optional views i.e. other than AP & Lateral view (%)	185 (17)	157 (15)	32 (10)	< 0.001
X-ray Erect view in the presence of chest PA view and Supine plain abdomen	Total X Rays for Acute abdomen	1917	1901	643	
	Total Erect Views (%)	921(48)	665 (35)	199 (31)	< 0.001
Obstetric USG	Total USG	8111	8194	1926	
	Total Obstetric USG (%)	1190 (15)	737 (9)	106 (5.5)	< 0.001

Table-7: Improvement in Fund Utilization as a Result of Rationalization Campaign (Pak Rs)

Total Expenses on Irrational Investigations	Phase I	Phase II	Difference	Projected Expense of 3 months had there been *No Campaign*	Phase III	Difference
Radiology	994,510	644,410	350,100	248,627.5	136,250	112,377
Laboratory	10,456,410	9,315,650	1,140,760	2,614,102.5	1,968,770	645,332
Total	11,450,920	9,960,060	*1,490,860*	2,862,730	2,105,020	*757,710*

DISCUSSION

A health care delivery system cannot work properly without an adequate investigation service. The increasing cost of laboratory and radiological equipment and consumables is constantly a point of concern for health administrators. While pathologists and radiologist, being usually well-versed with the preciousness of these items show their concern from time to time at different forums but there is a need to put an orchestral effort in this results. Reduction in the overall radiological referrals achieved in our study is lower as compared to that in UK study[5] but more importantly we stressed on replacement of unhelpful or obsolete investigations with rationalized tests both in laboratory and radiology – replacement of fat with flesh- so as to say.

Due to increase in the workload with each passing year, percentages were used for

comparison instead of total numbers to depict the changing pattern of test advice. The data retrieval method used for the study was mostly quantitative because it was not possible to retrieve personal particulars and clinical details for such a large number of patients. Phase III (i.e. post campaign period) was only of three months duration as compared to Phase I and II (one year each), the purpose was to see the short term effects, similar to the short term changes seen in St Georges Study[6]. Furthermore, the effects of campaign start diluting as a result of the rapid turn over of the staff due to peculiar nature of the hospital in which study was carried out.

Our study has shown a significant increase in FBG and decrease in RBG and a significant increase in OGTT for borderline cases and for the screening of GDM. FBG and OGTT are internationally recommended tests for the diagnosis of DM[10,11] because they can be standardized while RBG and 2hABF cannot be interpreted correctly if not clearly on either side of a wide range. Our campaign could not result in a prominent decrease in 2hABF because this test is also used for monitoring of DM and secondly RBG and 2hABF are sometimes used synonymously in our set up. Prior to this campaign there was no evidence-based method used for the diagnosis of GDM while one step and two step tests are now more frequently used instead of RBG. Similarly, an increase in the percentage of ALT alone indicates a change in the behavior of advising doctors to use ALT as a screening test for liver disease. Use of four tests i.e. urea, creatinine, sodium and potassium for the exclusion of renal disease was quite common in otherwise normal patients. As a result of our campaign there was a significant decease in the percentage of such patients. The percentage of patients undergoing electrolytes separate from renal function tests rose sharply while the number of abnormal electrolyte results increased by almost 4 folds. These two changes indicate the judicious use of electrolyte estimation and increased confidence of advising doctors in this investigation. Exclusion of AST and LDH for the diagnosis of acute myocardial infarction is now a "textbook knowledge"[12,13]. These two tests have been replaced by CK-MB and other more specific markers like Troponins etc. Our campaign resulted in significant reduction in number of patients advised all three enzymes. Since the availability of sensitive assays of TSH, use of all three tests for screening of thyroid dysfunction has been abandoned even in the developed countries[14]. So doctors, especially medical specialists are quite aware of this fact and advise only TSH. The increased use of TSH as screening test was mainly achieved by creating awareness in junior doctors.

In this study there is a measurable increase in useful radiological investigations as a result of campaign, all of the changes are statistically significant, too. We advocate the use of appropriate guidelines for referring physicians, delisting tests that are completely inappropriate, implementing the use of radiology information systems thus enhancing radiologist efficiency. Reduction in unnecessary X-Ray exposures leads to decrease in cost of the investigations and unnecessary radiation exposures. It can also result in shortening of the waiting times for access to diagnostic imaging. Such strategies are helpful in maximizing radiology's efficiency and ensure that services are being used appropriately.

Reduction of expenses incurred on irrational laboratory and radiological investigations was achieved by awareness campaign and not by refusing tests due to unavailability of funds. These unnecessary and unhelpful investigations were causing not only drainage of funds but also wastage of precious man hours and wear and tear of equipment. These resources are now being utilized for more helpful, scientific and evidence-based investigations, so there may not be an overall reduction of expenses incurred on investigations but these funds and human resources are more rationally used.

Conclusion: The present study clearly indicates that a proactive approach in the form of teamwork can result in improvement of rationalization of laboratory and radiological investigations. However, to obtain a sustained

effect, this behavior change communication should be made part of the organization culture.

REFERENCES

1. Clarke RM, Mason B, Leeder SR. Cost and effectiveness of clinical investigation: the state of the art; Aust N Z J Med. 1980;10(5):572-80.
2. Danica Popovic, Rational laboratory diagnostic and possibilities of inadequate analyses application. Clinical Center of Montenegro. *www.biyokimya.org/belge/sunu_bclf/06.09.2007/Popovic.ppt*
3. Volpe R. Rational use of thyroid function tests. Crit Rev Clin Lab Sci. 1997 ;34(5):405-38.
4. Blachar, S. Tal, A. Mandel, I. Novikov, G. Polliack, J. Sosna, Y. et al. Preauthorization of CT and MRI Examinations: Assessment of a Managed Care Preauthorization Program Based on the ACR Appropriateness Criteria® and the Royal College of Radiology Guidelines *Journal of the American College of Radiology*, , 11(3), 851-859
5. vos Meiring, P., Wells, I.P. (1990), "The effect of radiology guidelines for general practitioners in Plymouth", *Clinical Radiology*, Vol. 42 pp.327-9.
6. Oakeshott, P., Kerry, S.M., Williams, J.E. (1994), "Randomized controlled trial of the effect of the Royal College of Radiologists' Guidelines on general practitioners' referrals for radiographic examination", *Br. J. Gen. Pract.*, Vol. 44 pp.197-200.
7. Kerry, S., Oakeshott, P., Dundas, D., Williams, J. (2000), "Influence of postal distribution of the Royal College of Radiologists' Guidelines, together with feedback on radiological referral rates, on X-ray referrals from general practice: a randomized controlled trial", *Family Practice*, Vol. 17 pp.46-52.
8. Stead, J., Round, A. (1999), "Feedback of X-ray frequency: a controlled trial between primary care groups", *J. Clinical Excellence*, Vol. 1 pp.133-6.
9. McQueen MJ Overview of evidence-based medicine: challenges for evidence-based laboratory medicine. Clin Chem. 2001; 47(8):1536-46.
10. World Health Organization (1999) Definition, Diagnosis and Classification of Diabetes Mellitus and its Complications. WHO Publication
11. Laurie Barclay, MD Fasting Blood Glucose Levels in Diabetes Linked to Ischemic Stroke Risk http://www. medscape.com/viewarticle/571654.
12. Fred S A and Allan S J, Cardiac Function: In Burtis CA, Ashwood ER, Bruns DE (ed) Teitz Textbook of Clinical Chemistry. 4th ed. W. B. Saunders Company; 2006; 11629-1635.
13. Wlmsley RN, White GH; A Guide to Diagnotic Clinical Chemistry. 3rd ed Blackwell Scientific Publications. 300-309
14. Ladenson PW, Singer PA, Ain KB, Bagchi N, Bigos ST, Levy EG, et al. American Thyroid Association Guidelines for Detection of Thyroid Dysfunction. Arch Intern Med. 2000;160:1573-5.