https://doi.org/10.29309/TPMJ/2024.31.10.7917

The Professional Medical Journal
www.theprofesional.com
2024, Volume, 31 Issue, 10

ORIGINAL ARTICLE

Effect of anemia in patients having with surgical emergency laparotomy in a peripheral set-up of Punjab.

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Article Citation: Azeem M, Cheema K, Nazir MT, Ahmad H, Siddique MT, Mahmood T. Effect of anemia in patients having surgical emergency laparotomy in a peripheral set-up of Punjab. Professional Med J 2024; 31(10):1405-1412. https://doi.org/10.29309/TPMJ/2024.31.10.7917

ABSTRACT… Objective: To determine the effect of anemia in patient undergoing emergency laparotomy and post-operative complications. **Study Design:** Prospective observational study. **Setting:** We monitored individuals having emergency laparotomies at a tertiary care hospital. **Period:** June 2021 to May 2023. **Methods:** Patients undergoing emergency laparotomies for various reasons. Post-operative complications were the main variable noted in this study. Estimation of risk for complications analyses by using Poisson regression method in patient with anemia. Approval was obtained from the local ethics committee with reference number: SMC/0058. **Results:** About 76 patients, mostly male (79.3) with median age of 42 years. Complications were noted in 16.3% (12). 14 patients (23%) were pre-operatively anemic at time of operation. Patients with moderate to severe anemia had more complications post-operatively (96% CI). **Conclusion:** Anemia increase the risk of complications and morbidity of patients undergoing emergency laparotomies due to various reasons but anemia is amenable to increase the morbidity and complications post-operatively.

Key words: Anemia, Emergency Laparotomy, Peripheral Set-ups.

INTRODUCTION

Apart from global inequities regarding access of surgical facilities, such disparity and its outcome seen in the developing countries at its periphery surgical care center.[1,2] However, as per direction of WHO, resources are being increased to build up surgical capacity to cater difficulties at such resources limited peripheral area of the countries. To improve the situation at such undeveloped areas, data of morbidity and mortality is needed to be improved for better surgical outcome.[3] Death within 30 days after surgery usually counted for measurement of surgical quality.[4,5] Mortality rate is quite high in unprivileged and deprived poor community at peripheral set-up as compared to high-income setting in the center of country and death rate is twice that of global average.[6] A meta-analysis showed that mortality in emergency laparotomy is three time higher in developing country as compare to developed countries.[7] At resource rich center, complications after operation can be independently predict mortality and long-term survival.[8,9] There is lack of published data on perioperative outcome from deprived and under-developed peripheral area of Punjab, Pakistan which hindering the approach to identify predictors of mortality to improve the surgical quality care. Therefore, it is must to identify the risk factors which increase the mortality so that to modify the practice for safe approach.

Anemia is one of the modifiable risk factors for poor surgical outcome. The high incidence of anemia is seen in the peripheral area of Punjab due to malnutrition, chronic infection like tuberculosis and worm infestation.[10,11]

The prevalence of anemia is about 18% but varies with age and sex.[12] The lack of facilities of blood products due to storage problem and donor availability, blood transfusion in peripheral region is not an easy accessible approach. So, we are studying the impact of anemia on postoperative

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Article received on: 25/10/2023
Accepted for publication: 08/08/2024

outcome undergoing emergency laparotomy.

METHODS

This prospective observational study last for two years from (June 2021 to May 2023) of patients underwent laparotomy for various reasons after taking ethical approval (Ref# SSMC/HR/CC/23, Date: 24/10/2023) from hospital at Narowal Punjab. It is tertiary care but limitation in access to surgical care due to lack of postoperative data, updated blood bank and blood products are scarce. All patients admitted and operated for laparotomy or readmitted with complications were included in this analysis. Patients with age less than 15 years or hemoglobin, excluded from the study. The outcome measure was occurrence of complications and hospital mortality.

Information regarding patient's demographic aspect, hepatitis screening, hemoglobin, surgical diagnosis and surgical procedures were collected and tabulated. Postoperative complications were recorded based on European Peri-operative Clinical Outcome (EPCO) as defined in Chapter of Surgical Society of Surgeon Pakistan.[13] We took blood sample at time of admission for complete blood count and hemoglobin. Anemia was defined as mild, moderate or severe based on WHO definition.[14]

Hemoglobin value less than 11.0 g/dl for both male and female were admitted as anemic. Patients were followed from day of admission to discharge or death in post-operative period. Patients were evaluated by Sr. Registrar daily and three time in a week by the consultant concerned for any complication. Record of complication were done by the 1st Author (MA) after diagnosis by the senior consultant. Diagnosis of complication made on the basis of clinical judgment, sometime need adjuncts investigations to reach definite diagnosis.

The variable collected were, surgical site infection, intra-abdominal collection, anastomotic leak, wound dehiscence or entero-cutaneous fistulas. Univariate used for continuous variables. We used bivariate analysis with or without knowing pre-operative hemoglobin level of patients underwent laparotomy to know any systemic difference between these groups. Same kind of analysis was made between no/mild anemias versus moderate/severe anemia group to the primary outcome. C2 used for categorical variables. Student's t-test used for normal distribution of continuous variables. Kruskal-Wallis test for abnormal distribution of continuous variables. Patient's characteristics being evaluated against no or mild anemia versus moderate/severe anemia by bivariate analysis. We used multivariate Poisson regression analysis to quantify risk factors with any significant difference between patients having no/mild versus moderate/severe anemia in post-operative period. The risk factors which may be associated with post-operative complications include anemia- moderate to severe, age, sex, patient's classification based on American Society of Anesthesiologist (ASA). We use StataCorp v 16.0, College Station Texas for all statistical calculations. Confidential intervals 95% and set alpha at 0.05 for this study.

RESULTS

About 203 cases registered for surgery in a period of six months for various reasons, only 76 patients were selected for the study and rest were excluded for various reason as mentioned in Figure-1. Out of 100 patients, who underwent laparotomy, 24 were excluded due to non-availability of hemoglobin results preoperatively.

In Table-I outcome of surgery with anemia or without anemia and demographic aspect given in detail. Patient without hemoglobin reports preoperative were mostly having dire emergency ($p< 0.005$). There was no significance difference in age with $P<0.06$, physical status of patients and indication for surgery among 76 patients with known hemoglobin. Among 76 patients underwent laparotomy with known hemoglobin, 11 patients (14.9%) were having mild anemia and 18 patients (24%) had moderate to severe anemia at time of operation (Figure-1). The majority of 76 patients underwent laparotomy were emergency operation (n=58, 77.1%). 14% (11) patients develop abdominal complications and 9% (n=6) develop surgical site infection. Intraabdominal sepsis in (n=3) 5%, anastomotic

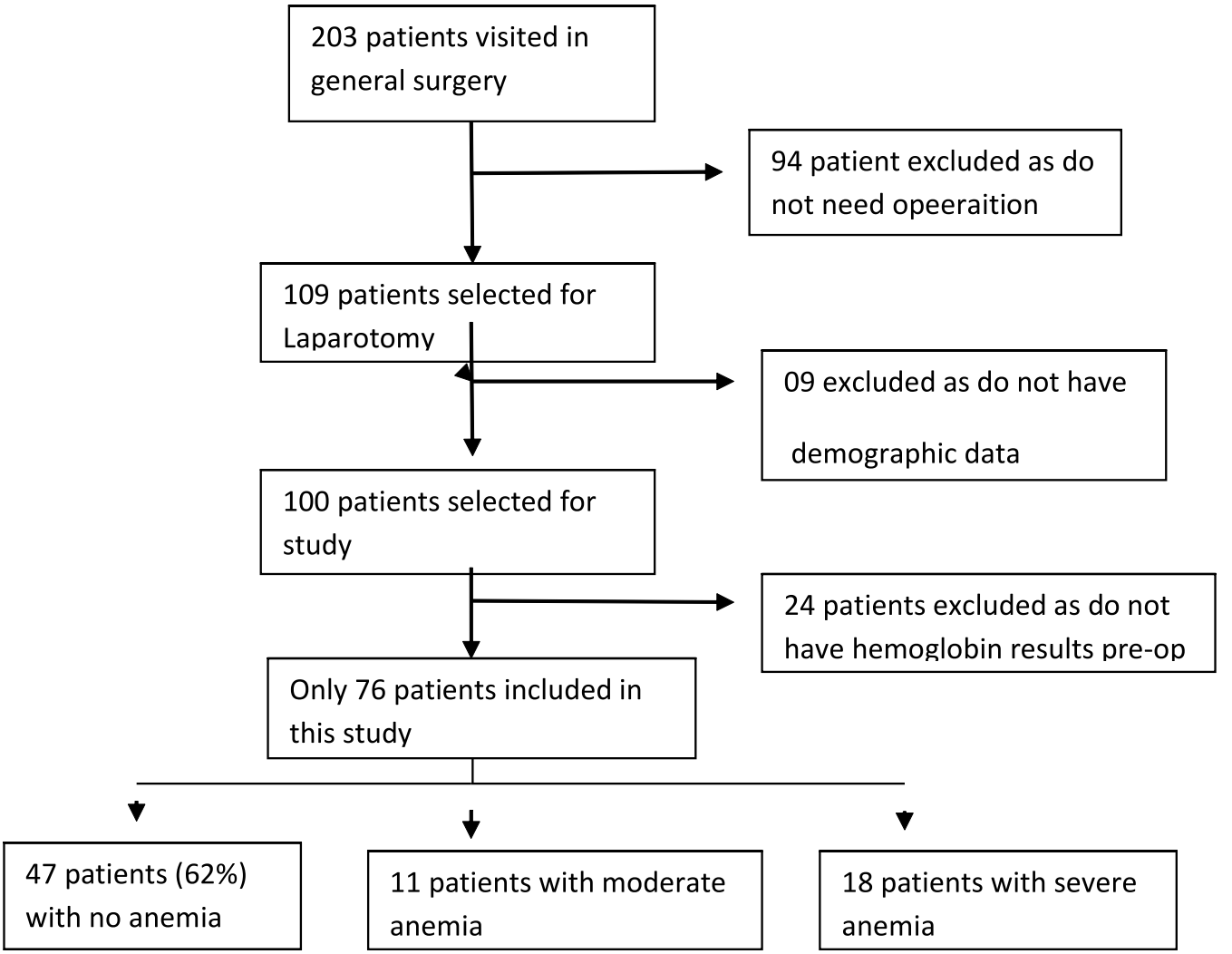

Figure-1. Exclusion criteria of Patients undergoing laparotomy.

Anemia severity	Male	Non-pregnant female	Pregnant female
No anemia	≥ 13.0	≥ 12.0	≥ 11.0
Mild	11.0 - 12.9	11.0 - 11.9	10.0 – 10.9
Moderate	8.0 - 10.9	8.0 - 10.9	7.0 – 9.9
Severe	< 8.0	< 8.0	< 7.0

Figure-2. Definition of anemia by World Health Organization

leak in 4 patients (6.1%) and wound dehiscence in (n=2) 3.4% patients. As a whole mortality rate was 15.2% (Table-II) and reoperation for abdominal complication was 9.2% (n=7).

Patients underwent laparotomy having mass abdomen were likely to have moderate to severe anemia (Hb<11.0 g/dl), further patients with trauma and higher ASA score also noted to have low hemoglobin. Patients with severe anemia have long hospital stay after operation (9 days versus 5 days, p<0.002) and admitted in ICU (41.2% versus 13.3%, p<0.001) in immediate post-operative time and complications particularly

abdominal one (31.4% versus 14.4%, p< 0.001. There was no significance difference in mortality regarding mild or severe anemic patients underwent operations.

The factors which associated with complications apart from anemia were physical status, younger age group and smoking (Table-III). Commonest presentation for operation in this study was bowel perforation (n=44, 58.1%) and intestinal volvulus (n=8, 8.2%). Complications were not significantly associated with specific indication of operation (Table-IV). Multivariable Poisson regression model was used to know about the effect of patient and operative factors, including anemia, on developing complications. In this study / moderate/severe anemia was an independent predictor of increased risk of complications (RR 4.2, 95% CI 3.07- 8.60, p< 0.001).

DISCUSSION

Abdominal exploration is necessary to diagnose and manage patients with acute abdomen by emergency or elective approach. Its major undertaking and May associated with morbidity and mortality.[8,14,15]

In this study at peripheral of Punjab with limited resources, it has been seen that patients undergoing laparotomy with anemia carries high risk of complications as compare to patient with mild or no anemia.

Patients having moderate to severe anemia are usually female, ASA status 3, intra-abdominal perforation of hallow viscus due to chronic infection or tumor and inflammation/abscess abdomen.

	Overall N=100	Preoperative Hb Present N=76 (76.0%)	Preoperative Hb Absent N=24 (24.0%)	P-Value
Median age	39[24-50]	42[24-62]	34.5 [32.-54.]	0.5
Male sex: n (%)	75 (75%)	65 (86.66%)	10 (13.33%)	0.05
Prior abdominal surgery: n (%)	20 (20 %)	18 (90.00%)	2 (10.00%)	0.06
Emergency: n (%)	80 (80.00%)	66 (82.5.5%)	14 (17.5%)	0.009
Trauma: n (%)	09 (9.0 %)	06 (66.66%)	03 (33.33%)	0.7
ASA class: n (%) 1- 2- 3- 4- 5-	 44 (44.00%) 37 (37.00%) 17 (17.1%) 1 (1.0 %) 0 (0.0%)	 31 (70.45%) 30 (81.08%) 14 (82.35%) 1 (100 %) 1 (100 %)	 13(29.55%) 07 (18.91%) 3 (17.65%) 0 (0.0%) 0 (0.0%)	0.3
Wound class: n (%) Clean Clean- Wound contaminated Contaminated Dirty	 21 (21.0%) 25 (25.00%) 15 (15.00%) 29 (29.0%)	 14 (66.66%) 19 (76.0%) 11 (73.33%) 22 (75.86%)	 07 (33.33%) 06(24.0%) 04 (26.66%) 07 (24.13%)	0.8
Postoperative disposition: n(%) Ward ICU	 83 (83.0%) 16 (16.00%)	 6 (75.0%) 13 (81.25%)	 21 (25.30%) 03 (18.75%)	0.3
Diagnostic category: n (%) Ventral hernia Bowel perforation Volvulus Abdominal mass Inflammation/Abscess Solid organ injury Others	 08 (8.0%) 44 (44.0%) 08 (08.0%) 09 (9.1%) 06 (6.0%) 20 (20. %) 01 (01.0%)	 6 (75.0%) 42 (95.45%) 06(75.0%) 06 (66.66%) 03 (50.0%) 16 (80.0%) 1 (100.00%)	 02(25.00%) 02 (4.55%) 02 (25.0%) 03 (33.33 %) 02 (50.0%) 04 (20.0%) 00 (0%)	 0.3 0.3 0.2 0.7 0.7 0.3 0.7

Table-I. Patients with known and unknown level of hemoglobin (Hb) with operative characteristics

I think as evident from data, that this is the first study which evaluate preoperative anemia with other risk factors causes post-operative complication at peripheral center of Punjab. Anemia is common because of malnutrition, chronic infection and worm infestation of the community at this far flung area.[11,13,16] The most common chronic infection is Tuberculosis. About 2.1 million people annually registered for treatment of this disease.[10,17] The combination of malnutrition- iron deficiency, and chronic infection lead to anemia.[13]

Why female having more pronounce anemia due to malnutrition, chronic infection and poor hygiene with more problem of menstrual bleeding. Surgically treatable diseases are the highest burden at peripheral health care system of Punjab.[16] Surgery is cost effective, if indicated, and critical element in improving the health of people. Presence of tertiary health care at periphery of Punjab definitely improving surgical capacity and expanding gradually health care facilities for the community. However, due to limited resources, surveillance after operation may not increase to a level to check the real burden of morbidity and quality of surgical care.

The complications have been identified as major risk factor for mortality, reduce the survival to 81% according to Khuri et al.[18] In our study, at least one abdominal complication is about 14.1% and over all complications are quite high as compare to Weiser TJ et al.[19]

	Overall N=100	Preoperative Hb 11.0 g/dL N=57 (76.1%)	Preoperative Hb < 11.0 g/dL N=18 (25.1%)	P-Value
Median age of patients	39 (23-59)	42 (26-62)	34 (20-45)	0.06
Male sex: n (%)	75(75.1%)	45 (81.1%)	09 (54.5%)	<0.001
Median value of Preoperative Hb	12.5 (11-15.4)	13.4 (12.9-15.9)	9.1 (7.5-10)	<0.001
Emergent: n (%)	80 (80.1%)	45 (80.1%)	11 (67.0%)	0.06
Trauma: n (%)	09 (9.1%)	04 (8.1%)	03 (19.1%)	0.01
ASA class: n (%) 1 2 3 4 5	 40 (40.1%) 39(39.0%) 18(18.1%) 1 (1.0 %) 1 (01.0%)	 25 (45.1%) 22 (40.2%) 08 (16.1%) 0 (0.0%) 1 (2.0 %)	 04 (24.0%) 07 (41.3%) 05 (32.0%) 1 (4.1%) 0 (0.0%)	0.02
Wound class: n (%) Clean Clean contaminated Contaminated Dirty	 19 (19.5%) 25 (25.0%) 16 (16.1%) 39 (39.0%)	 6 (18.0%) 16 (30.1%) 10 (18.1%) 20 (37.3)	 04 (28.1%) 02 (14.6%) 2 (11.0%) 08 (48.1%)	0.06
Diagnostic category: n (%) Ventral hernia Bowel perforation Volvulus Abdominal mass Inflammation/Abscess Solid organ injury Others	 08 (8.0%) 44 (44.0%) 08 (08.0%) 14 (14.0%) 06 (6.0%) 20 (20.0%) 02 (02.0%)	 03 (6.0%) 38 (67.1%) 38 (67.1%) 02 (5.7%) 04 (8.1%) 02 (3.9%) 0(0.0%)	 0 (0.0%) 05 (32.2%) 01 (6.4%) 04 (21.9%) 02 (10.3%) 02 (10.1%) 9 (16.7%)	 0.07 0.5 <0.001 <0.001 0.7 0.02 0.08
Postoperative disposition: n (%) Ward ICU	 83 (83.0%) 16 (16.00%)	 50 (89.5%) 06 (12.2%)	 10 (61.3%) 07 (40.4%)	<0.001
Abdominal complication: n (%)	15 (15.1%)	6 (11.3%)	05 (30.5%)	0.001
Mortality: n (%)	13 (13.1%)	06 (12.9%)	03 (19.5%)	0.2
Postoperative length of stay,	7 (4-8)	6 (4-7)	8 (5-11)	<0.002

Table-II. Patients with moderate/severe anemia <10.8 g/dl preoperatively and their characteristics.

	Overall N=100	Abdominal Complication	No Abdominal Complication	P-Value
Median age of patients	42 (24-49)	32 (20-38)	38 (25-51)	0.02
Male sex: n (%)	75 (75.1%)	09 (66.7%)	63 (76.1%)	0.4
Preoperative Hb,	13.1 (3.2)	11.6 (3.2)	13.4 (3.2)	0.004
Mild Anemia: n (%)	15 (15.2%)	4 (11.8%)	30 (15.8%)	0.5
Moderate/Severe anemia: n (%)	24 (24.1%)	16 (47.1%)	38 (20.0%)	0.001
Consultant involved: n (%)	58 (58.6%)	22 (64.7%)	69(61.6%)	1.0
ASA class: n (%) 1 2 3 4 5	 40 (40.1%) 39(39.0%) 18(18.1%) 1 (1.0 %) 1 (01.0%)	 3 (15.8%) 10 (52.6% 6 (31.6%) 0 (0.0%) 0 (0.0%)	 37 (43.2%) 31 (36.9%) 13 (15.7%) 1 (0.7%) 1 (0.7%)	
Wound class: n (%) Clean Clean contaminated Contaminated Dirty	 19 (19.5%) 25 (25.0%) 16 (16.1%) 39 (39.0%)	 1 (3.2%) 8 (25.8%) 4 (12.9%) 18 (58.1%)	 41 (22.2%) 48 (26.0%) 30 (16.2%) 66 (35.7%)	 0.04
Diagnostic category: n (%) Ventral hernia Bowel perforation Volvulus Abdominal mass Inflammation/Abscess Solid organ injury Others	 08 (8.1%) 44 (44.0%) 08 (08.1%) 14 (8.5%) 06 (6.0%) 20 (4.9%) 23 (10.3%)	 0 (0.0%) 14 (41.2%) 7 (20.6%) 1 (2.9%) 2 (5.9%) 2 (5.9%)	 10 (5.3%) 49 (25.8%) 51 (26.8%) 18 (9.5%) 16 (8.4%) 69 (4.7%)	 0.2 0.07 0.4 0.2 0.6 0.8 0.8
Postoperative disposition. n (%) Ward ICU	 180 (81.8%) 40 (18.2%)			0.005
Mortality: n (%)	30 (13.4%)	10 (29.4%)	20 (10.5%)	0.003
Stay after operation	6 (4-8)	11.5 (8-17)	5 (4-7)	<0.001

Table-III. Patient with complications and without complications.

	Relative Risk of Complication	95% Confidence Interval	P-Value
Male sex	0.90	0.90	0.8
Age (years)	1.00	0.97-1.03	0.8
Emergency surgery	3.12	0.66-14.84	0.2
Moderate/severe anemia	4.44	2.05-9.60	<0.001
Bowel perforation	2.67	0.68-10.47	0.2
ASA Class I II III, IV, V	 4.10 1.94	 1.28-13.10 0.50-7.53	 0.02 0.3
Wound class: n (%) Clean Clean contaminated Contaminated Dirty	 4.18 5.08 2.39	 0.46-38.31 0.56-45.84 0.23e24.36	 0.2 0.1 0.5
Postoperative disposition. n (%) Ward ICU	 0.75	 0.30-1.87	 0.5

Table-IV. Multivariable Poisson regression model to predict the relative risk of abdominal complications based on patient and management characteristics.

Anemia negatively impact upon surgical outcome and utilization of resource.[18,20] The prevalence of anemia is 9.7% as a whole, while its 2.1% and 14.2% in male and female respectively. Our analysis showed that moderate to severe anemia increase complication postoperatively which is comparable to previous research done at high income settings.[20,21,22]

Postoperative complications in moderate to severe anemia is inconclusive in study of Musallam et al and Richards et al. However, White et al showed that 8.4-fold increase in postoperative complications in patients with severe anemia. Lagoo et al found no relationship of anemia and complications in post-operative outcome. Patient with anemia may usually have comorbid conditions, malnutrition, diabetes and respiratory disease, which negatively affect surgical outcomes. 59 However, our study showed low hemoglobin preoperatively increase the risk of postoperative complications and may be used as a marker to have close monitoring in postoperative period. It's evident that moderate to severe anemia increased the odds of complication and mortality.[24]

For the said reason, in resource-limited settings to modify anemia as a risk factor may be essential for reduction of complications. However, research is needed to quantify the risks and benefits of preoperative blood transfusion in severe anemic patient in our circumstances. Due to limited resource for surveillance and diagnostic adjuncts, we may not report complications with sufficient confidence for analysis and may underestimated complications. Post-operative follow-up is a challenge in our setting with limited data collection and analysis of hospital events.

CONCLUSION

The mortality and morbidity are high in-patient undergoing laparotomy in our tertiary care having anemia but this is modifiable risk factor which increase abdominal complications after operation. Preoperative recognition of moderate to severe anemia can give benefit to patients postoperatively by more close surveillance for better outcome.

CONFLICT OF INTEREST

The authors declare no conflict of interest.

SOURCE OF FUNDING

This research received no specific grant from any funding agency in the public, commercial, or not-for-profit sectors.

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No.	Author(s) Full Name	Contribution to the paper	Author(s) Signature
1	M. Azeem	Acquisition, analysis, or interpretation of data.	
2	Kamran Cheema	Critical review of the manuscript for important intellectual content.	
3	Muhammad Tariq Nazir	Concept of the manuscript.	
4	Habib Ahmad	Design of manuscript.	
5	Muhammad Tariq Siddique	Drafting of the manuscript.	
6	Tahir Mahmood	Statistics analysis.	