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Evaluate of Leucocyte Count, Erythrocyte Sedimentation Rate and C-reactive Protein Levels in Patients with Acute and Chronic Inflammation in Al ajaylat City – Libya

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دراسة تقييمية لمعدل ترسيب كريات الدم الحمراء، وتعداد كريات الدم البيضاء، ومستويات بروتين سي التفاعلي في المرضى الذين يعانون من الالتهابات الحادة والمزمنة في مدينة العجيلات – ليبيا

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Abstract

Inflammatory and infectious diseases are considered as the major causes of sickness and death. Thus, identification of inflammatory diseases markers is a significant tool for the disease's diagnosis and their treatment evaluation. C-reactive protein (C-RP), Erythrocytes sedimentation rate (ESR) and total leucocytes count (TLC) measure the markers that represent the inflammation level in the body at the time of the test and considered as conventional methods of inflammatory diseases preliminary diagnosis. The aim of this study was to evaluate C-RP, ESR and TLC among patients suffer from acute inflammation, chronic inflammation and infection diseases. This study was conducted at Al ajaylat diagnostic laboratories, a sum of 103 blood samples were collected from patients (37 males and 66 females) with different inflammatory and infectious diseases. The samples were tested for C-RP, ESR and TLC. The markers were measured at different stages of diseases course. A questionnaire was used including patient lifestyle, demographic information, preclinical and clinical data, and diagnosis that were collected and analyzed. The percentage of samples that showed abnormal ESR were (89.32%), and C-RP was high in (52.43%) and 24 patients had variations in TLC (23.30%). This study showed that there were no significant differences between ESR and C-RP in both acute and chronic inflammatory conditions. Their levels were useful during treatment follow-up in most acute inflammation. ESR was more value in chronic inflammatory process. Changes in blood cells count were likely to be more prevalent during chronic inflammation. The combination of three tests was more valuable than single test despite their divergence results and significant effects of patient's gender.

Keywords: Erythrocyte sedimentation rate; ESR; C-reactive protein; C-RP; Total leukocytes count; Acute medical conditions; chronic medical conditions.

الملخص

تعتبر الأمراض الالتهابية والمعدية من الأسباب الرئيسية للمرض والوفاة. يمكن أن يؤدي تحديد العلامات الالتهابية لتقييم نشاط المرض والاستجابة للعلاج إلى تحسين التشخيص على المدى الطويل. يعد قياس البروتين التفاعلي سي (C-RP) ومعدل ترسيب كريات الدم الحمراء (ESR) وعد كريات الدم البيضاء الكلية (TLC) من العلامات التي تمثل مستوى الالتهاب في الجسم وقت الاختبار وتعتبر طرقًا تقليدية للتشخيص الأولي للأمراض الالتهابية. كان الهدف من هذه الدراسة هوتقييم البروتين التفاعلي سي ومعدل ترسيب كريات الدم الحمراء وعدد كريات الدم البيضاء الكلية بين المرضى المصابين بأمراض التهابية ومعدية حادة ومزمنة.
أجريت هذه الدراسة في مختبرات التشخيصية بالعجيلات، حيث تم جمع 103 عينة دم من مرضى (37 ذكرو66 أنثى) يعانون من أمراض التهابية ومعدية مختلفة. وتم فحص العينات لمعرفة C-RP و ESR و TLC. وتم قياس العلامات في مراحل مختلفة من مسار المر ض. وتم جمع استبيان يتضمن نمط حياة المريض والمعلومات الديموغرافية والتشخيص والبيانات السريرية .وكانت نسبة العينات التي أظهرت ESR غير طبيعية (89.32%)، وكان C-RP مرتفعًا في (52.43%) وكان لدى 24 مريضًا اختلافات فيTLC (23.30%). وأظهرت هذه الدراسة عدم وجود فروق كبيرة بين ESR وC-RP في كل من الحالات الالتهابية الحادة والمزمنة ومستوياتها مفيدة أثناء متابعة العلاج في معظم الالتهابات الحادة. ESR أكثر قيمة في العملية الالتهابية المزمنة .من المرجح أن تكون التغيرات في عدد خلايا الدم أكثر انتشارًا أثناء الالتهاب المزمن. إن الجمع بين الاختبارات الثلاثة أكثر قيمة من اختبار واحد على الرغم من نتائج التباعد بينهما والتأثيرات المهمة لجنس المريض.

الكلمات المفتاحية: معدل ترسيب كريات الدم الحمراء؛ ESR؛ البروتين التفاعلي -سي؛ C-RP؛ عدد كريات الدم البيضا ء الكلي؛ الحالات الطبية الحادة؛ الحالات الطبية المزمنة.

Introduction

Infection and inflammation are presented with inflammatory manifestations, which associated with haematological and immunological changes. Inflammation is clinical symptoms of many diseases, which is characterized by cardinal signs of inflammation that can be recognized clinically by five signs: redness, worm, swelling, pain, and loss of organ function (Zigterman and Dubois, 2022). These clinical symptoms explained by the biochemical and molecular changes of body tissues, including immune and hematologic changes such as alteration of leucocytes and inflammatory mediators. Thus, these changes have been used widely as diagnostic tools for different sorts of tissue injury, inflammation and infection (Foy, *et. al*., 2021). Based on the duration of the inflammation course; there are two main forms of inflammation; acute and chronic. Acute inflammation occurs instantly after injury and lasts for few days. If acute inflammation fails to resolve, it becomes chronic inflammation, which may last for months or even years (Hannoodee and Nasuruddin, 2023).

Acute inflammation is initiated by specific injury that trigger release of inflammatory mediators such as acute phase proteins, cytokines, and chemokines, which promote migration of neutrophils and macrophages to the injury site. Different immunocytes for example macrophages and monocytes play a role in both acute and chronic inflammation. The chronic inflammation also involves migration of T lymphocytes and plasma cells to the inflammation site and if the inflammation persists without recovery, then tissue damage and fibrosis will be resulted (Tu and Li, 2023).

Examples of acute inflammatory response are allergic reaction, chemical and mechanical irritation, microbial infection, and burns. These will become chronic if they are not cured. Whereas, example of chronic inflammation response are cardiovascular diseases, autoimmune diseases, rheumatoid and cancer (Chen, *et. al.,* 2017).

During inflammation phases, many inflammatory mediators are released by immunocytes and hepatocytes, which known as acute phase reactants (APR) or inflammatory markers including pro-inflammatory and anti-inflammatory signaling molecules. Inflammation process is causing significant changes of APR and plasma proteins serum concentrations, which lead to accelerate of erythrocyte sedimentation rate (ESR) (Gulhar, *et al.,* 2023). Inflammation process is causing significant changes of APR and plasma proteins serum concentrations, which lead to accelerate of erythrocyte sedimentation rate (ESR) (Gulhar, *et al*., 2023).

Pro-inflammatory signaling cytokines e.g. Interleukin-6 induce and promote synthesized of C-reactive protein (C-RP) by hepatocytes, whose level increases in response to inflammatory and infectious process. C-RP is an acute-phase reactant protein that plays a role as pro-inflammatory and anti-inflammatory mediators in inflammation response, dysregulation of its role may cause inflammatory disorders such as autoimmune

processes, e.g. idiopathic thrombocytopenic purpura. Several adverse effects can be resulted by APR. Which include fever, chronic anemia, anorexia, drowsiness, amyloidosis, weakness, and fat and muscle loss (Sproston and Ashworth, 2018).

Depending on APR serum concentrations during inflammation, they can be classified as positive or negative. Positive APR are upregulated, and their concentrations increase during inflammation such as procalcitonin, C-RP, hepcidin, ferritin and fibrinogen. Negative APR are downregulated and decrease during inflammation such as pre-albumin, albumin, transferrin, retinol-binding protein, and anti-thrombin (Gulhar, *et al*., 2023).

Inflammatory markers are protein in nature and can be measured in laboratory to detect and monitor the inflammations process; the most commonly tests used are ESR and C-RP alongside with other laboratory techniques such as complete blood count (CBC). Thus, physicians commonly request ESR and C-RP for precisely investigate, diagnose and follow up a number of complicated diseases.

Although, APR including C-RP and ESR have been named as acute phase reaction. However, they have been considered as both acute and chronic responses associated with different disorders (Kushne, 1982). Both C-RP and ESR are usually raised in acute inflammatory response but their patterns of increase are different, C-RP increases within short time of onset of inflammation and returns to normal within few days if the acute inflammation is resolved. In contrast, ESR increases slowly and stays high for long time (Bray *et al.,* 2016). C-RP direct measures of inflammatory protein in inflammatory response; ESR indirectly measures the level of inflammation via measurement of the rate of ESR in inflammation. As C-RP and ESR results depending on the level of blood protein, thus they are affected by numerous factors such as pathophysiological conditions and gender and even body mass index, blood protein concentrations and erythrocytes morphology (Harrison, *et al*., 2014).

Although ESR and C-RP tests have low specificity and effected by numerous factors, they are still valuable when used in combination with other clinical and diagnostic investigations. For example, combination of C-RP and ESR with total leukocytes count (TLC) is important as sensitive markers of inflammation in terms of rapid result for decision-making (Hayreh, *et al*., 1997). C-RP and ESR are frequently used together for detection or monitoring suspected inflammation or infection however, their results can disagree in about 33 % of cases. This disagreement may due to an intercurrent illness and different time of their elevations, i.e. C-PR increases and decreases faster than the ESR (Gulhar, *et al.,* 2025).

Complete white blood cells (WBCs) count or total TLC and differential WBCs count is routinely used as blood parameters investigation of allergic reaction, cancer, inflammation and infection. Normal level of TLC in healthy adult ranges from 4000 to 11000/µL of blood (Tigner, *et al.,* 2022).

Measurement of the WBCs (part of the CBC) is usually conducted as a monitor of WBCs number, which might increase, or decrease according to different diseases. In addition to mal-functionality of hematopoietic system, WBCs number may increase because of diseases like bacterial infections, inflammation e.g. rheumatoid arthritis and vasculitis, leukaemia, myeloproliferative neoplasms and allergies conditions. While WBCs number decreases due to chemotherapy, radiation therapy, lymphoma, autoimmune disorders and some viral infection such as human immunodeficiency virus (Guo, *et al.,* 2021).

As clinical markers of inflammation; ESR, C-RP and TLC are widely used in inpatient and outpatient clinics for diseases diagnosis and monitoring of the response to treatment. The complete recovery of inflammation normalizes the ESR, C-RP and TLC and other inflammatory parameters (Firestein, *et al.,* 2012).

Thus, the aim of this study was to investigate and evaluate of TLC, C-RP and ESR in patients during chronic and acute inflammation and infectious diseases stages. In addition to, evaluation of the combination of C-RP, ESR and TLC to monitor pathological conditions during disease prognosis.

Materials and methods

This cross-sectional study included patients aged 20 to 100 years who have been attended the outpatient clinics of Al ajaylat Hospital over a period of six months from November 2023 to April 2024. All selected patients were presented with different types of inflammatory and infectious (bacterial or viral) conditions. Different phases of diseases or inflammation were tested, such as acute or chronic phases; patients whom suffer from hematologic and related conditions such as bleeding disorders were excluded in this study.

A total of 103 blood samples were collected and subjected to examine by using; the TLC, ESR, and C-RP testes. All procedures have performed in this study was involving human participants who have agreed to participate and their heath information to be collected and used in this study by using the prepared questionnaire. Verbal consent were obtained from patients whom participate in the study. Amelioration of clinical manifestations such as reduction in fever, reduction of ESR and normalization of C-RP were marked as an improvement of the disease conditions.

Determination of ESR

To measure ESR, Westergren method was used according to manufacture protocol (Tishkowski and Gupta, 2023). Briefly, 2 ml of venous blood transferred into a tube containing 0.5 ml of sodium citrate. Into Westergren-Katz tubes, blood was filled up to the 2 mL mark. The tubes were placed in a rack at room temperature in a strictly vertical position without disturbance for 1 hour where erythrocytes were precipitated and plasma was separated under the influence of the gravity. After an hour, the distance from the lowest point of the surface meniscus to the upper limit of the erythrocyte's sediment was measured. The distance of fall of erythrocytes was expressed as mm in one hour. Since the ESR, value is typically affected by gender and age, it is higher in females than males and it increases gradually with age (Assasi and Blackhouse *et al.,* 2015). Thus, we considered normal or abnormal values of obtained ESR according to Westergren method as in Table 1.

Table 1: Normal Erythrocyte sedimentation rate (ESR) value based on gender and age mm/hr (Tishkowski and Gupta, 2023 - Al-Marri, and Kirkpatrick, 2000 - Böttiger and Svedberg, 1997).

Gender	Age	Normal ESR value
Male	< 50 years	≤ 15 mm/hr
	≥50 years	≤ 20 mm/hr
Female	< 50 years	≤ 20 mm/hr
	≥50 years	≤ 30 mm/hr
Child	-	≤10 mm/hr

The ESR ≥ 30 mm/hr was considered as an abnormal ESR.

Determination C-RP

Fresh serum samples were obtained from centrifuged blood samples for the measurement of C-RP level. C-RP was measured by the Latex agglutination method according to manufacturer instruction (Cam Tech Medical, London, United Kingdom, 2021), where C-RP in blood conjugates with anti-C-RP antibody to form agglutination. C-RP Latex reagent is a polistyrene Latex suspension coated with goat IgG anti-human C-RP. When C-RP is present in the sample, agglutination shows a C-RP content of at least 6 mg/L (0.6 mg/dL) (without sample pre-dilution).

Less than 0.3 mg/dL was considered as normal level in most healthy adults. Reading from 0.3 to 1.0 mg/dL was also considered as a normal or minor elevation due to some factors such as obesity, pregnancy, depression, diabetes, common cold, gingivitis, periodontitis, sedentary behaviour, and cigarette smoking. More than 1.0 mg/dL is considered as positive or elevated (Nehring, *et al.,* 2023).

Total Leucocytes Count

Total leucocytes count was carried out using automated cell counting and sizing that is used to analyze of the whole blood samples using BC-2800 Mindray Analyzer according to manufacturer protocol (Shenzhen Mindray Bio-Medical Electronics Co., Ltd, Shenzhen. China, 2013). Manual Single Tube Closed Vial were used for each sample. We considered normal level of TLC between 4,000 and 11,000/µL of blood. (Tigner, *et al.* 2022).

Statistical analysis

The statistical analysis was performed by SPSS 18 software (IBM, Armonk, NY, USA). Descriptive statistics were used to describe the data and difference between two groups were examined by Chi-square test for categorical variables. *P*-value ≤ 0.05 was considered as statistically significant.

Results

In this study, participated males patients were 35.92% (n=37), while females were 64.08% (n = 66) from a total number (103) of patients. The results of ESR, C-RP and TLC show that the C-RP was positive in (52.43%) *n* = 54, while the ESR was abnormal in (89.32%) *n* = 92 and the TLC was abnormal in (23.30%) *n* = 24, as shown in Table 2.

Table 2: C-RP, ESR and TLC tests results for all 103 patients (TLC = Total leukocyte count, ESR = erythrocytes sedimentation rate and C-RP = C reactive protein).

Test	Results	
	Positive	Negative
C-RP	54 (52.43%)	49 (47.57%)
	Abnormal	Normal
ESR	92 (89.32%)	11 (10.68%)
TLC	24 (23.30%)	79 (76.70%)

Based on the questionnaire and medical history of patients. The type of medical conditions were 63 (61.17%) of patients suffer from chronic inflammatory conditions, while 40 (38.83%) where suffer from acute inflammatory conditions Table 3. Acute diseases were pneumonia, upper respiratory tract infection including tonsillitis, acute gastroenteritis, and acute urinary tract infection, while chronic inflammatory conditions were diabetes mellitus, inflammatory bowel disease and rheumatoid arthritis.

Table 3: The number of patients based on type of inflammatory conditions.

Inflammatory condition	Number of patients	Percentage of patients
Acute inflammatory condition	63	61.17%
Chronic inflammatory conditions	40	38.83%

Test results of ESR based on medical conditions is presented in Table 4, where 92 (89.32%) of participants had abnormal ESR. The abnormal ESR is higher among those who had acute illness (93.65%) comparing to those who suffer from chronic illness (82.50%) with no statistical significant difference ($P > 0.05$).

Table 4: The results of abnormal ESR based on medical conditions (ESR = erythrocytes sedimentation rate)**.**

Type of medical condition	Number of patients	Abnormal ESR	Normal ESR
Acute illness	63	59 (93.65%)	4 (6.35%)
Chronic illness	40	33 (82.50%)	7 (17.50%)
Total	103	92 (89.32%)	11 (10.68%)
P-value	$P = 0.074131$ ($P > 0.05$)		

Table 5 shows the C-RP results based on medical conditions, in the acute conditions the positive results were higher than chronic conditions, which were statistically significant differences ($P < 0.05$).

Table 5: The results of abnormal C-RP based on medical conditions (C-RP = C reactive protein).

Type of medical condition	Number of patients	Positive C-RP	Negative C-RP
Acute illness	63	38 (60.32%)	25 (39.68%)
Chronic illness	40	16 (40.00%)	24 (60.00%)
Total	103	54 (52.43%)	49 (47.57%)
P-value	$P = 0.044188$ ($P < 0.05$)		

The correlation between TLC and medical conditions of the patients have been shown in table 6 indicating that abnormal TLC results were higher in chronic conditions (32.5%) comparing to acute illnesses (17.46%) ($P > 0.05$).

Table 6: The results of abnormal TLC (TLC= total leucocytes count) based on medical conditions.

Type of medical condition	Number of patients	Normal TLC	Abnormal TLC (low or high)
Acute illness	63	52 (82.54%)	11 (17.46%)
Chronic illness	40	27 (60.5%)	13 (32.5%)
Total	103	79 (76.70)	24 (23.30%)
P-value	$P = 0.078549$ ($P > 0.05$)		

Based on the patient's age, C-RP, ESR and TLC distribution and frequency of the results are presented in Table7, which shows fluctuation results of C-RP and TLC while ESR trend to increase by older age without statistically significant differences ($P > 0.05$).

Table 7: The results of C-RP, ESR and total leucocytes count of TLC based on age of patients (*n* = number of patients, TLC = Total leukocyte count, ESR = erythrocytes sedimentation rate and C-RP = C reactive protein).

Age groups	***n***	**C-RP Results**	
		Positive	Negative
Total	103	54 (52.43%)	49 (47.57%)
0-20	18	11 (61.11%)	7 (38.88%)
21-40	15	8 (53.34%)	7 (47.66%)
41-60	40	18 (45%)	22 (55%)
61-80	26	14 (53.48%)	12 (46.52%)
81-100	4	3 (75%)	1 (25%)
P-value	$P = 0.6859$ ($P > 0.05$)		
Age groups	***n***	**ESR**	
		Abnormal	Normal
Total	103	92 (89.32%)	11 (10.68)
0-20	18	15 (83.33%)	3 (16.67%)
21-40	15	13 (86.67%)	2 (13.33%)
41-60	40	36 (90%)	4 (10%)
61-80	26	24 (92.31)	2 (7.69)
81-100	4	2 (50%)	2 (50%)
P-value	$P = 0.1873$ ($P > 0.05$)		
Age group		**TLC**	
		Increased	Normal
Total	103	24 (23.30%)	79 (76.70%)
0-20	18	4 (22.22%)	14 (77.78)
21-40	15	2 (13.33%)	13 (86.67%)
41-60	40	7 (17.5%)	33 (82.5%)
61-80	26	7 (26.92%)	19 (73.08%)
81-100	4	2 (50%)	2 (50%)
P-value	$P = 0.4978$ ($P > 0.05$)		

Table 8 presents the correlation between patient's gender and inflammatory markers, which generally highlights that the percentage of abnormal and/or positive results of TLC, ESR and C-RP were variable between female and male nevertheless of the patient's age.

Table 8: The results of ESR, C-RP and TLC based on patient's gender. *P* value < 0.05 is considered as statistically significant, (*n* = number of patients, TLC = Total leukocyte count, ESR = erythrocytes sedimentation rate and C-RP = C reactive protein).

Gender	**C-RP**		**ESR**		**TLC**	
	Positive	**Negative**	**Normal**	**Abnormal**	**Normal**	**Abnormal**
Male *n* =37 (35.92%)	*n* = 26 (70.27%)	*n* = 11 (29.73%)	*n* = 8 (21.62%)	*n* = 29 (78.38%)	*n* = 25 (67.57%)	*n* = 12 (32.43%)
Female *n* = 66 (%64.08)	*n* = 28 (42.42%)	*n* = 38 (57.58%)	*n* = 3 (4.55%)	*n* = 63 (95.45%)	*n* = 53 (80.30%)	*n* = 13 (19.70%)
Total *n* = 103	*P* value = 0.0066		*P* value = 0.0071		*P* value = 0.1481	

Discussion

Inflammation diagnosis depends on clinical manifestations alongside with laboratory investigations for inflammation markers. As inflammatory process includes biochemical and physiological alteration of blood such as increase of acute phase proteins e.g. C-RP, release of inflammatory mediators, such as cytokines and interleukins. Conventional laboratory investigations of inflammation includes tests that measure these hematologic changes e.g. C-RP, ESR, and complete leucocytes count or WBCs counts.

This study was amid to evaluate ESR, C-RP and TLC as diagnostic tools in inflammation conditions in patients who suffer from acute and chronic inflammation and its relation to age and gender. We found that, C-RP was positive in 54 patients (52.43%) and ESR was abnormal in 92 (89.32%) patients, whereas TLC was abnormal in 24 patients (23.30%) (Table 2). Although, these figures should have similar outcome as the patients were suffering from inflammation and/or infection, the variation in the results reflects the accuracy and sensitivity of each test. For instance, it has been known that C-RP is a better indicator and more sensitive and reliable marker of acute inflammatory conditions than ESR, because its increases is earlier than ESR. In addition, C-RP is a direct measure of the inflammatory progression. Whereas, ESR is an indirect measure of inflammatory process via measuring of the rate of settlement of erythrocytes, which increases due to surge of acute phase proteins. Moreover, false positive and false negative ESR results are more common due to the effect of numerus factors such as physiological conditions, age and gender variation (Harrison, 2015).

There is a correlation between the increase levels of C-RP that occurs in infections or inflammation and ESR elevation, as the raise of C-RP leads to elevation of ESR. However, this correlation might be discrepancies as ESR test gives false positive or negative, which may due to the C-RP increase earlier before ESR elevation. In addition, ESR may elevated due to physiological condition and some time it is not response to minor inflammatory conditions. Our study is corresponding to this assumption whereas we found that, the percentage of positive C-RP is 52.43% while, ESR was 89.32% abnormal (Table 2).

Total and differential leukocytes counts are also used as inflammatory markers in acute and chronic inflammation and monitoring of the presence of infection. The normal range of leukocytes count in adults is usually from 4500 to 11000 cells/µL of blood. Increases of leukocytes is known as leukocytosis and occurs in inflammation condition, as leukocytes are required for inflammatory process. On the other hand, leukopenia or low of leukocyte number is indicating of change of immunity, the presence of an infection that utilize supplies of leukocytes or defect of hematopoietic. The decreases in previously increased leucocytes to the normal level may indicate resolution of the inflammation process (El Brihi and Pathak, 2024).

Clinically, TLC is inexpensive, useful, and commonly available marker of inflammation. However, its diagnostic and prognostic importance are not clear in some inflammatory events (Daves, *et. al.,* 2015). Elevated TLC is a cardinal sign of acute inflammation, but minor elevation in TLC is non-specific, and the rates of change and resolution in leucocytes are associated with favorable acute inflammatory responses. Moreover, increase of TLC may occur in non-infectious inflammation and decrease in some viral infection (Li, *et. al.,* 2024). In this study, we reported variable results that reflects the diverse disease conditions and their stages. Among the conditions, that decrease leucocytes are defect of hematopoietic e.g. aplastic anemia, some viral infection such as hepatitis infection, pre-acute bacterial infection such as bacterial sepsis, chemotherapy, rheumatoid arthritis, malnutrition and lack of certain vitamins (Carter, 2017).

As hematopoietic disorders affect the blood components (Whichard, *et. al.,* 2010). Thus, we excluded patients who suffer from hematopoietic defects. Generally, our results show no significant variations ($p > 0.05$) in TLC among patients (TLC percentage was 76.70% normal and 23.30% abnormal), which may related to variation of TLC during inflammation process and disease progression, for example TLC increases after inflammation trigger and decrease by resolve of inflammation (Chmielewski and Strzelec, 2018).

As all participant patients have diagnosed with inflammatory conditions we evaluated each single test of ESR, C-RP, and TLC or combination all tests together as diagnostic and monitoring tools of inflammation. Thus based on inflammatory conditions, we divided participant patients to two groups; acute and chronic medical conditions and measured these inflammatory markers in both conditions. Using a questionnaire, we determined correlation between obtained results and age, sex and inflammatory conditions to understand of any association of ESR, C-RP and TLC with acute or chronic medical conditions, age or gender of patient. Out of total 103 patients, 63 patients were suffering from acute illness and 40 were diagnosed with chronic conditions. We found that number of patients with high ESR was slightly higher (93.65%) in acute illness comparing to chronic illness (82.5%). Slightly variation between acute and chronic conditions may due to ESR is normally increased in 24 to 48 hours after onset of inflammation and stayed high for months after resolve of inflammation (Bray, *et. al.,* 2016). Similar

findings have been reported that ESR is elevated in the same way in acute and chronic conditions (Ali, *et. al.,* 2019).

It has been reported excessively in literature that ESR is significantly affected by many factors such as gender, body mass index, age and erythrocytes morphology rather than infection or inflammation. In our study ESR was affected by age of patients, the level of ESR increased in elderly patients, similar finding has been reported indicating that ESR is increased by getting older (Siemons, *et. al.,* 2014 - Alende-Castro, *et. al.,* 2019). Therefore, age of patient should be considered when interpreting ESR test results.

Gender of patient is also among factors that affects ESR our results show variation of ESR between male and female ESR results were higher in female than male. Table 8. Similar result have been reported elsewhere showing that ESR higher in female than male (Emelike, *et. al.,* 2010). This may due to physiological factors such as menstruation. Thus, during menstruation, the hematocrit levels is significantly decreased resulting in faster sediment of red blood cells subsequently increase in ESR levels. Moreover, hematological parameters are normally different between male and female (Yousefzadeh and Khara, 2015).

Conclusion

No significant difference was found between C-RP and ESR as markers of acute and chronic diseases. Both C-RP and ESR had positive association with acute as well as chronic conditions. Elevation of ESR was seen more frequently in acute medical conditions comparing to C-RP. TLC shows variable results with more increase in chronic comparing to acute conditions. More studies are required for better understanding the sensitivity and the specificity of these markers in terms of diagnosing of acute or chronic medical conditions.

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