General Inflammation Testing AHS – G2155

**Definition**
Inflammatory response can occur due to tissue injury and/or various disorders, including arthritis, lupus, and infection. Acute phase reactants, such as serum C-reactive protein (CRP), are released in the acute phase response during inflammation and can be used to monitor inflammation. Inflammation can also be measured using the simple laboratory technique of erythrocyte sedimentation rate (ESR) (Kushner, 2019).

***Note: This Medical Policy is complex and technical. For questions concerning the technical language and/or specific clinical indications for its use, please consult your physician.***

**Policy**
BCBSNC will provide coverage for general inflammation testing when it is determined the medical criteria or reimbursement guidelines below are met.

**Benefits Application**
This medical policy relates only to the services or supplies described herein. Please refer to the Member's Benefit Booklet for availability of benefits. Member's benefits may vary according to benefit design; therefore member benefit language should be reviewed before applying the terms of this medical policy.

**When general inflammation testing is covered**
Reimbursement for measurement of erythrocyte sedimentation rate (ESR) for patients with Hodgkin Lymphoma is allowed.

Reimbursement for measurement of either C-Reactive Protein (CRP) or ESR in the diagnosis, assessment and monitoring of inflammatory disorders, and/or undiagnosed conditions, and/or to detect acute phase inflammation is allowed. (*please see Note 1).

**NOTE 1:** For policy regarding the use of CRP as a cardiac biomarker, please see policy AHS-G2150 Cardiac Biomarkers for Myocardial Infarction. For policy regarding ANA/ENA Testing for systemic autoimmune rheumatic diseases and idiopathic inflammatory myopathies, please see policy AHS-G2022 ANA/ENA Testing.

**When general inflammation testing is not covered**
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Reimbursement is not allowed for the measurement of both CRP and ESR, at the same visit, in the diagnosis, assessment and monitoring of inflammatory disorders, and/or undiagnosed conditions, and/or to detect acute phase inflammation.

Reimbursement is not allowed for the measurement of either CRP and/or ESR during general exam without abnormal findings.

Policy Guidelines

Background

Conditions Associated with Acute Inflammatory Responses

Diseases most associated with an acute inflammatory response measured by CRP and/or ESR include arthritis, especially rheumatoid arthritis (RA), polymyalgia rheumatica (PMR), giant cell arteritis (GCA), systemic lupus erythematosus (SLE), cardiovascular disease (CVD) (Kushner, 2019), and Hodgkin lymphoma (HL) (NCCN, 2018b). RA is an idiopathic, systemic polyarthritis that can lead to joint loss as well as tendon and ligament deformation to the point of affecting day-to-day living. RA is suspected in patients who present inflammatory polyarthritis and typically diagnosed via rheumatoid factor (RF) testing, anti-cyclic citrullinated peptide antibody (anti-CCP) testing, ESR, and/or CRP testing as well as imaging techniques (Venables & Maini, 2018). PMR “is an inflammatory rheumatic condition characterized clinically by aching and morning stiffness about the shoulders, hip girdle, and neck (Docken, 2017)”. PMR is frequently associated with GCA (also known as Horton disease), which is vasculitis of medium-to-large blood vessels and can include the aorta and cranial arteries. Cranial arteritis can lead to permanent vision loss. 40-50% of patients with GCA also suffer from PMR whereas 15% of all PMR patients are also diagnosed with GCA. Due to the inflammation of the aorta and aortic branches, aortic aneurysm and aortic dissection can occur in patients with GCA (Docken & Rosenbaum, 2017). In both PMR and GCA, ESR and CRP levels are typically elevated. SLE “is a complex autoimmune disease with chronic relapsing-remitting course and variable manifestations leading a spectrum from mild mucocutaneous to devastating, life-threatening illness…Epigenetic modifications mediate the effect of the environment on immunologic responses, eventually leading to an inflammatory, autoimmune, multi-systemic disease characterized by autoantibody production and tissue injury (Gergianaki & Bertsias, 2018).” Since patients with SLE can be prone to infection, ESR and CRP may be used in monitoring inflammation. CVD is a very common inflammatory disorder in the United States. Although serum CRP is a non-specific inflammatory marker and is not a causative agent of CVD, serum CRP can be used as a biomarker for CVD (Black, Kushner, & Samols, 2004; Kushner, 2019). Hodgkin lymphoma accounts for 10% of lymphomas and is characterized as a B-cell lymphoma “containing a minority of neoplastic cells (Reed-Sternberg cells and their variants) in an inflammatory background (Aster & Pozdnyakova, 2018)” . ESR is elevated in HL, and an ESR ≥50 is considered as an “early-stage unfavorable factor” (NCCN, 2018b).

Erythrocyte Sedimentation Rate (ESR)

Erythrocyte sedimentation rate (ESR) is a common laboratory method used to monitor general inflammation. ESR is used to analyze many different conditions, including rheumatoid arthritis (RA), systemic lupus erythematosus (SLE), arteritis, and polymyalgia rheumatica (PMR) (Kushner, 2019; Wu et al., 2010). The simple Westergren method of ESR consists of measuring the distance a blood sample travels in a tube within one hour. The International Council for Standardization in Hematology (ICSH) established a calibration reference to this method using citrate-diluted samples. Automated ESR methods have been established; however, some of these analyzers use different dilution solutions, such as EDTA, rather than citrate. EDTA is commonly used as an anticoagulant in hematology measurements whereas the use of citrate is less prevalent. Horsti et al. compared blood samples from 200 patients using the traditional Westergren method versus an EDTA-based method. Their data has an R^2 value of only 0.72 and 55 subjects had a difference of over 30%, clearly indicating that ESR is significantly affected by sample preparation methods (Horsti, Rontu, & Collings, 2010). ESR can also be affected by red blood cell morphology, ambient conditions (such as high room temperature or tilting of the ESR tube), anemia, renal disease, obesity, heart failure, and hypofibrinogenemia (Kushner, 2019; Taylor & Maini, 2017).
ESR can be affected by noninflammatory factors, thus reducing its specificity for inflammatory processes. Noninflammatory biological factors and environmental conditions can increase a sample’s observed ESR. If the serum sample contains elevated concentrations of ions or charged proteins, an elevated ESR can occur; for example, an increase in positively charged plasma proteins can result in agglutination of erythrocytes within a sample to result in rapid sedimentation (Hale, Ricotta, & Freed, 2019). The ICSH established a Working Group to investigate the ESR methodology used in laboratories, and they published their findings in 2017. They examined the data from over 6000 laboratories on four different continents. Of the laboratories included in the study, only 28% used the “gold standard” Westergren method exclusively (i.e. the method with the established validation by the ICSH) “while 72% of sites used modified or alternate methods”. The data obtained from the new methodologies could deviate from the Westergren method by up to 142% and could differ “from each other of up to 42%”. The ICSH released recommendations based up the results of these studies. One such recommendation for labs using the non-Westergren method of ESR is to “consider adding an interpretative comment to every result stating that ‘This result was obtained with an ESR instrument that is not based on the standard Westergren method. The sensitivity and specificity of this method for various disease states may be different from the standard Westergren method’” (Kratz et al., 2017).

C-reactive Protein (CRP)
C-reactive protein (CRP) was first discovered in the early twentieth century when it was isolated in a co-precipitation reaction with the pneumococcal C polysaccharide. The polysaccharide component bound by CRP later was identified to be phosphocholine. Since then, studies have shown that CRP can bind a number of ligands other than bacterial cell wall components. During an acute inflammatory response, hepatocytes can upregulate CRP synthesis more than 1000-fold. The increase in serum CRP “after tissue injury or infection suggests that it contributes to host defense and that it is part of the innate immune response” (Black et al., 2004). Determining CRP concentration and fluctuations in plasma CRP can be useful in monitoring inflammatory response; however, what dictates “normal” CRP levels is of debate since CRP concentrations can vary considerably between individuals, people groups, and laboratory testing methodology. The units used to denote CRP concentrations also vary between laboratories (Kushner, 2019).

Clinical Validity and Utility of CRP and ESR in Measuring Inflammatory Processes
Both CRP and ESR have been used to monitor RA. Elevated CRP and ESR does correlate to observed radiologic damage in RA. Unlike ESR, CRP can be evaluated on stored serum, which could be advantageous due to the time constraints of ESR testing (Taylor & Maini, 2017). A 2009 study by Crowson et al. show that the use of both ESR and CRP testing in the case of RA is not warranted. They examined the data from three randomized trials of 1247 RA patients. “Where available, the CRP alone may be preferred for disease activity assessment as a simple, validated, reproducible, non age-dependent test” (Crowson, Rahman, & Matteson, 2009). Since both ESR and CRP have been incorporated into composite scoring for RA, the elimination of one or the other will not hinder the quantitative evaluation of the patient using a composite scoring system such as DAS (Disease Activity Score) or SDAI (Simplified Disease Activity Index). A 2015 Danish study clearly show that the data obtained in DAS using either ESR or CRP “are interchangeable when assessing RA patients and the two versions of DAS28 are comparable” (Nielung et al., 2015). This study compared the baseline data and one-year follow-up of 109 different patients with RA using the DAS28-ESR and DAS28-CRP. Using the EULAR (European League Against Rheumatism” response criteria, only 14 patients show a divergence between using the ESR and CRP methods. Of those 14, “12 showed a better response (in terms of responder category) using DAS28-CRP, while two patients showed a better response using DAS28-ESR”. However, a 2006 study by Fransen and van Riel show that it is still possible for a patient to have a high number of swollen joints and yet receive a low DAS28-ESR score within the remission range due to a low ESR value since ESR has a significant weight on the DAS28-ESR algorithm (Fransen & van Riel, 2006). This study did not include CRP measurements to compare its validity to that of the DAS28-ESR. Another study released in 2010 (Hensor, Emery, Bingham, & Conaghan, 2010) shows that the DAS28-CRP could also underestimate RA remission rates since those values are usually lower than the corresponding
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DAS28-ESR values, but the discrepancy is not significant if age and gender are added as factors into the DAS28-CRP methodology. To confound issues, “newer biologic agents that target specific inflammatory cytokines are differentially reflected in the ESR and CRP and may therefore disproportionately deflate the composite score (Anderson et al., 2012).”

ESR cannot be used to predict RA as a screening method. Suarez-Almazor and colleagues investigated the predictive value of ESR for connective tissue diseases (CTD) and RA. Their review of 711 records by more than 300 different primary care physicians in Alberta show that ESR positively predicted 35% for CTD and only 17% for cases of RA. For SLE, the positive predictive value for ESR was even lower at only 3%. They did not include CRP testing in this study. The authors note that “most tests were negative, and were often requested in patients without CTD, resulting in low positive predictive values and questionable clinical utility” (Suarez-Almazor et al., 1998). A study by Keenan and colleagues (Keenan, Swearingen, & Yazici, 2008) compared the utilization of ESR and CRP in RA, SLE, and osteoarthritis. Their data show that for the 188 patients with RA, the number of patients with both ESR and CRP elevated were statistically the same as those with normal test levels or those with only one test elevated. They concluded “that another look at the role of ESR and CRP as markers of inflammation in RA patients seen in routine care may be in order (Keenan et al., 2008).”

Bitik and colleagues researched the use of elevated ESR and CRP levels in distinguishing the definitive diagnosis of a rheumatic disorder from patients with nonspecific inflammation. In their study of 112 patients, 47 had a previously diagnosed rheumatic disorder and 65 had no history of a rheumatism. Of the 65 patients with no history of a rheumatic disorder, 52.3% were diagnosed with a new rheumatic disorder with PMR/GCA comprising 38.2%, while 47.7% had a non-rheumatic diagnosis. Within this latter group, only the “CRP levels were significantly higher in infections when compared with new onset RD or malignancies (p < 0.05) (Bitik et al., 2015)”. The ESR levels between the three groups were statistically insignificant. This indicates that CRP is more sensitive to acute infections than ESR. The authors state that “although ESR and CRP levels have a very low specificity in differentiating between these conditions, in cases of unusually high levels of CRP (especially above 200), more consideration should be given to infections or malignancies.”

A 2014 study of 60 different PMR patients compared the efficacy of ESR and CRP in assessing disease activity versus patient-reported outcomes and plasma fibrinogen. In this study, the VASDA (Visual analog scale disease activity) and VASQOL (VAS quality of life), two patient-reported outcome methods were the most responsive to changes in disease activity. Of the serum biomarkers, fibrinogen, ESR, and CRP, fibrinogen was the most accurate with a correlation coefficient of 1.63 whereas 1.2 and 1.05 were the correlation coefficients of ESR and CRP, respectively. These data suggest that plasma fibrinogen would be a more sensitive measure of PMR disease activity as compared to either ESR or CRP (McCarthy et al., 2014).

A two-year retrospective study released in 2010 (Ernst, Weiss, Tracy, & Weiss, 2010) researched the validity of using either ESR and/or CRP in assessing septic joints. This study consisted of 163 patients and included both genders as well as patients with alcohol or drug histories. The mean ESR value for the 119 control non-septic joints was 46 while the septic joint mean ESR value was 56, which was not significant (with a P > 0.05); however, the mean CRP value was 14 in the septic joints and 8 in the non-septic joints (P < 0.01, significant). The conclusion of the authors is “CRP is helpful in determining the presence of a septic joint; ESR is not (Ernst et al., 2010).”

ESR is used in determining the algorithm to follow in the treatment of Hodgkin lymphoma (CHL). For example, in stage 1A CHL, a patient with an ESR <50 would follow either the NCCN HODG-3 or HODG-4 algorithm with an initial 2-3 cycles of ABVD (Adriamycin, bleomycin, vinblastine, dacarbazine) most likely whereas a stage 1A patient with an ESR >50 would follow the NCCN HODG-6 algorithm with a possible involved-site radiation therapy (ISRT) initially along with the chemotherapy since an ESR >50 is considered an “unfavorable factor” (NCCN, 2018b).
CRP elevation is associated with a number of inflammatory disorders (including RA), tissue damage (such as after a myocardial infarction), as well as bacterial infections; however, CRP levels in SLE do not mirror disease progression (Kushner, 2019). Even during cases of severe disease phenotypes, CRP levels can be normal to modestly increased. One possible reason is CRP suppression by type I interferons, which are increased in SLE. Another possibility is that low concentrations of wildtype CRP play a role in lupus. “Three lines of investigation have raised the possibility that low plasma levels of CRP may be related to the pathogenesis of SLE: 1) an association between SLE and several CRP genetic polymorphisms, at least one of which is associated with low CRP levels, 2) the possibility that low CRP levels may contribute to defective clearance of autoantigens during apoptosis, and 3) the therapeutic efficacy of CRP in mouse models of SLE (Gaitonde, Samols, & Kushner, 2008).” Also, CRP and anti-CRP may form large complexes in patients with SLE, which could also decrease the serum concentrations of free CRP (Gordon et al., 2018). A study by O’Neill and colleagues in 2010 show that anti-CRP levels are directly proportional in an increase to disease activity (32.6, 24.8, and 16.8 AU, respectively, for high activity, low activity, and control groups) and that anti-CRP levels were above the upper limit of normal in 26.3% of the high activity cases versus only 12.8% for the low activity cases (O’Neill et al., 2010). Patients with SLE usually have elevated ESR, but this elevation may be due to persistent polyclonal hypergammaglobulinemia (Gordon et al., 2018).

State and Federal Regulations, as applicable
Testing of serum acute phase reactants and ESR is performed in laboratories meeting Clinical Laboratory Improvement Act (CLIA) quality standards. The FDA has approved multiple tests for human CRP, including assays for conventional CRP, high sensitivity CRP (hsCRP), and cardiac CRP (cCRP). On September 22, 2005, the FDA issued guidelines concerning the assessment of CRP (FDA, 2005). A search of the FDA Medical Devices database (FDA, 2018) on June 12, 2018, shows that the FDA has approved ESR systems from multiple companies, including the ESR Control -M Hematology Erythrocyte Sedimentation system (K972172) and the ESR Control -HC Hematology Erythrocyte Sedimentation system (K972170) by R & D Systems, the Sedilizer Erythrocyte Sedimentation Rate System (K953994) from Becton Dickinson Vacutainer Systems, the Westergren Dispette for ESR (K831195) by Ulster Scientific, and the Dade ESR Kit (K823368) from American Dade.

Guidelines and Recommendations

2018 World Health Organization (WHO) (Ghebreyesus, 2018)
On May 16, 2018, the WHO released their first edition of the Model List of Essential In Vitro Diagnostics (EDL) “to advance universal health coverage, address health emergencies, and promote healthier populations”. This list of in vitro diagnostics (IVD) is to be used as a reference of the essential diagnostic tools for laboratories to complement their Model List of Essential Medicines. With respect to the diagnostic tool “to detect inflammation as an indicator of various conditions”, the WHO recommends CRP either in an EIA (enzyme immunoassay) or RDT (rapid diagnostic test) assay format. The specimen type can be venous whole blood, serum, or plasma.

2018 National Comprehensive Cancer Network (NCCN)
The 2018 NCCN guidelines concerning Hodgkin Lymphoma (NCCN, 2018b) uses ESR as a diagnostic tool in characterizing the type of Classic Hodgkin Lymphoma (CHL) as well as the primary treatment of the disease. In the diagnosis/workup of Hodgkin Lymphoma in adults (age ≥18 years) (recommendation 2A), they list erythrocyte sedimentation rate (ESR) as “essential” and that ESR should be tested within 6 months of diagnosis; in fact, ESR is used extensively in the treatment algorithm for CHL as depicted in the table below (NCCN, 2018b).
In the guidelines concerning follow-up after completion of treatment (recommendation 2A), they list under laboratory studies “ESR (if elevated at time of initial diagnosis)” up to five years. ESR is also used in determining the dosage of involved-site radiation therapy (ISRT). “A dose of 20 Gy following ABVD X 2 is sufficient if the patient has non-bulky stage I-IIA disease with an ESR <50, no extralymphatic lesions, and only one or two lymph node regions involved.” An ESR ≥50 is considered as an “early-stage unfavorable factor”. Please note that the NCCN guidelines concerning Hodgkin Lymphoma do not contain any information concerning the use of CRP as a diagnostic or prognostic tool (NCCN, 2018b).

In the NCCN guidelines concerning the B-cell lymphomas under the section concerning Castleman’s Disease (NCCN, 2018a), the NCCN recommends (category 2A) as “essential” laboratory tests “LDH, CRP, [and] ESR”. Within the discussion of the text, it does not mention if all three are required or if only a minimum of one of the three tests are essential in the workup. The guidelines for B-cell lymphomas do not list either CRP or ESR for follow-up testing post-treatment.

In the NCCN guidelines concerning the T-cell lymphomas, they state that the “evaluation of serological markers such as rheumatoid factor (RF), antinuclear antibodies (ANA), and erythrocyte sedimentation rate (ESR) is useful in patients with autoimmune disease” (NCCN, 2018c). [Please note that the Avalon policy AHS-G2022 covers ANA testing.] The guidelines concerning T-cell lymphomas do not mention the diagnostic or prognostic use of CRP.

2015 American Society for Clinical Pathology (ASCP) (Pathology, 2015)
In the Choosing Wisely site of the ABIM Foundation, the ASCP released the recommendation to not “order an erythrocyte sedimentation rate (ESR) to look for inflammation in patients with undiagnosed conditions. Order a C-reactive protein (CRP) to detect acute phase inflammation” due to the sensitivity and specificity of CRP for acute phase of inflammation. “In the first 24 hours of a disease process, the CRP will be elevated, while the ESR may be normal. If the source of inflammation is removed, the CRP will return to normal within a day or so, while the ESR will remain elevated for several days until excess fibrinogen is removed from the serum.”

2009-2018 European League Against Rheumatism (EULAR)(Colebatch et al., 2013; Combe et al., 2017; Dejaco et al., 2018; Dejaco et al., 2015; Mukhtyar et al., 2009)
In 2009, EULAR issued their recommendations concerning the management of large vessel vasculitis. With a “Level of Evidence 3, Strength of recommendation C”, they recommend “monitoring of therapy for large vessel vasculitis should be clinical and supported by measurement of inflammatory markers…. For patients with giant cell arteritis, a relapse is usually associated with a rise in ESR and CRP” (Mukhtyar et al., 2009). In this paper, no mention of the frequency of ESR and/or CRP testing is mentioned.
In 2013 in EULAR recommendations for the use of imaging of the joints in the clinical management of rheumatoid arthritis (Colebatch et al., 2013), they state that “baseline inflammatory disease measured by scintigraphy appears to be associated with radiographic progression. In addition, multiple regression analysis has demonstrated that progression of radiographic joint destruction was primarily predicted by $^{99m}$Tc-IgG scintigraphy; joint swelling, ESR and IgM RF (Rheumatoid Factor) were not predictive. This suggests that scintigraphy may be superior to conventional clinical and laboratory measurements in the prediction of joint destruction.” This set of guidelines did not include any mention concerning CRP or the frequency of ESR testing.

In 2015, EULAR and the American College of Rheumatology (ACR) issued joint recommendations concerning the management of polymyalgia rheumatica (PMR) (Dejaco et al., 2015). Within their recommendations, they list assessments that “every case of PMR should have…prior to the prescription of therapy (primary or secondary care)”. They include a basic laboratory workup “to exclude mimicking conditions and establish a baseline for monitoring of therapy”, and they state that this includes “rheumatoid factor and/or anti-cyclic citrullinated peptide antibodies (ACPA), C-reactive protein and/or erythrocyte sedimentation rate (ESR), blood count, glucose, creatinine, liver function tests, bone profile (including calcium, alkaline phosphatase) and dipstick urinalysis.” They do not state a specific preference of either CRP or ESR nor do they state the frequency of testing.

EULAR in 2016 updated their 2007 recommendations concerning the management of early arthritis (Combe et al., 2017). The 2016 updates included the following recommendation: “Monitoring of disease activity should include tender and swollen joint counts, patient and physician global assessments, ESR and CRP, usually by applying a composite measure. Arthritis activity should be assessed at 1-month to 3-month intervals until the treatment target has been reached.” The recommendation concerning including both ESR and CRP did not change between the 2016 and 2007 recommendations. Within the discussion of the recommendations, they state, “In every patient with active arthritis, closely monitoring disease activity is now considered of particular importance in the therapeutic strategy to provide a good outcome…. Monitoring disease activity should be as frequent as the level of disease activity mandates, usually every 1-3 months, then potentially less frequently (such as every 6-12 months) once the treatment target has been achieved. Nevertheless, three changes were proposed to this item…. First, a composite measure was recommended as the method of choice to monitor disease activity; second, a specific time frame for monitoring structural damage was deliberately left out and third, patient-reported outcomes were expanded beyond fundamental assessments” (Combe et al., 2017).

In 2018, EULAR issued EULAR recommendations for the use of imaging in large vessel vasculitis in clinical practice (Dejaco et al., 2018). They make no recommendation concerning the preference of ESR or CRP nor do they state the frequency of testing; they do state “in patients with a high clinical suspicion of GCA (>50%), for example, in case of new-onset headache, visual symptoms, jaw claudication and elevated erythrocyte sedimentation rate (ESR) and C reactive protein, a positive ultrasound would result in a post-test probability of >95%.”

2012-2016 American College of Rheumatology (ACR) (Anderson et al., 2012; National Guideline, 2016; Singh et al., 2015; Ward et al., 2016)

In 2012, ACR released their recommendations concerning the clinical practice of using disease activity measures of rheumatoid arthritis (RA) (Anderson et al., 2012). The recommend using the Disease Activity Score with 28-joint counts (DAS28), the Clinical Disease Activity Index, the Patient Activity Scale (PAS), the PAS-II, the Simplified Disease Activity Index (SDAI), and Routine Assessment of Patient Index Data with 3 measures. The DAS28 is a composite test that can use either CRP or ESR data. The ACR states that both the CRP or ESR used in the DAS28 have been validated in RA. Of the six activity measures recommended by the ACR, only DAS28 received “excellent” recommendations for all three psychometric properties—reliability, validity, and responsiveness. Within the guidelines, the ACR also issued the scores corresponding to remission, low/minimal, moderate, and high/severe RA for all of the disease activity measures, including the DAS28, as well as the mathematical formula using either CRP or ESR data to
determine the DAS28. CRP is also used in the SDAI; however, the SDAI is rated as “good” for reliability because they state that “test-retest reliability for composite has not been evaluated” for the SDAI. No mention of frequency of testing is made. They do note that the “inclusion of acute-phase reactants in the DAS28 and SDAI complicates the logistics and timing using these measures in point-of-care clinical decision making. Although these measures have traditionally been used in clinical trials, academic medical centers, and large multispecialty clinics, logistical barriers have likely delayed their widespread adoption in smaller practice settings (Anderson et al., 2012).”

The ACR in 2015 (Singh et al., 2015) issued guidelines for the treatment of RA. While not specifying a preference of either CRP or ESR in diagnosing or predicting the prognosis of RA, they do state in their “Key provisos and principles” that “functional status assessment using a standardized, validated measure should be performed routinely for RA patients, at least once per year, but more frequently if disease is active.” They also state that disease activity be measured using ACR-validated scales, including the aforementioned DAS28 and/or SDAI. Moreover, they define RA remission as “a tender joint count, swollen joint count, C-reactive protein level (mg/dl), and patient global assessment of ≤1 each or a Simplified DAS of ≤3.3, 1 of 6 ACR-endorsed disease activity measures”.

Also, in 2015 (but published in 2016), the ACR and the Spondylitis Association of America (SAA) issued their joint recommendations concerning the treatment of ankylosing spondylitis (AS) and nonradiographic axial spondyloarthritis (National Guideline, 2016; Ward et al., 2016). Regarding “the treatment of patients with either active or stable AS…we conditionally recommend regular-interval use and monitoring of the CRP concentrations or erythrocyte sedimentation rate (ESR) over usual care without regular CRP or ESR monitoring.” This received a “very low-quality evidence; vote 100% agreement” rating. They do make note that as of the time of publication “no studies addressed the effect of routine monitoring of a disease activity measure” but that “the panel thought that monitoring would be most helpful in patients with active symptoms as a guide to treatment.” Testing is not required for every clinic visit.

2013 American Academy of Family Physicians (AAFP) (Caylor & Perkins, 2013)
In 2013, the AAFP released Recognition and Management of Polymyalgia Rheumatica and Giant Cell Arteritis. For polymyalgia rheumatica (PMR), they note that “a normal ESR is found in 6% to 20% of persons with [PMR], although in those cases C-reactive protein level is elevated. ESR predicts relapse more reliably, but C-reactive protein is more sensitive, and is less affected by age and other factors (Caylor & Perkins, 2013).” For giant cell arteritis (GCA), ESR is elevated in up to 89% of patients, but the sensitivity and specificity increase to 99% and 97%, respectively, if both ESR and CRP are tested. Regardless of using either ESR or CRP testing, the AAFP recommends that either ESR or CRP is tested at each clinic visit for patients with either PMR or GCA.

2014 American College of Radiology (ACR) (Ha et al., 2014; National Guideline, 2014)
The ACR released their updated guidelines concerning the follow-up of Hodgkin lymphoma in 2014. They state that “limited data are available on the role of routine blood work in detecting relapses”. ESR is listed as one of the tests conducted as routine blood work in follow-up of Hodgkin lymphoma. They summarize their findings as the following: “In general a majority of recurrences can be detected initially by history and physical examination rather than by routine imaging studies or blood tests such as ESR, CBC, and chemistry (Ha et al., 2014).” Four of the five variants they reviewed had ESR tests conducted 1 – 2 times per year, and the ACR rated the use of ESR as a 3, 5, 5, and 7 in these four variants where a “3” indicates “usually not appropriate”, a “5” is “may be appropriate”, and a “7” falls in the “usually appropriate” category.

2010-2018 The British Society for Rheumatology (BSR) & British Health Professionals in Rheumatology (BHRP) (Dasgupta, 2010; Dasgupta, Borg, Hassan, Alexander, et al., 2010; Dasgupta, Borg, Hassan, Barraclough, et al., 2010; Gordon et al., 2018)
In 2010, BSR and BHPR issued joint guidelines concerning the management of giant cell arteritis (GCA) (Dasgupta, 2010; Dasgupta, Borg, Hassan, Alexander, et al., 2010). They recommend “early recognition and diagnosis of GCA is paramount. Particular attention should be paid to the
predictive features of ischaemic neuro-ophthalmic complications.” As part of this diagnostic recommendation, they specifically list laboratory tests that should be included—“full blood count, urea and electrolytes, liver function tests, CRP, ESR”. They note that, although elevated ESR and CRP levels are hallmarks of GCA, “GCA can occur in the face of lower levels of inflammatory markers, if the clinical picture is typical”. Another specific recommendation states, “Monitoring of therapy should be clinical and supported by the measurement of inflammatory markers (C; this is a consensus statement)” and that at each visit “full blood count, ESR/CRP, urea and electrolytes, [and] glucose” lab tests be performed.

Also, in 2010, BSR and BHPR issued joint guidelines concerning the management of polymyalgia rheumatica (PMR) (Dasgupta, Borg, Hassan, Barracough, et al., 2010). For PMR, they recommend initial lab testing for diagnosis to include either ESR and/or CRP prior to initiating long-term steroid therapy. Also, during such therapy, they recommend monitoring either ESR or CRP every three months. This is a portion of the recommendation (B) of “vigilant monitoring of patients for response to treatment and disease activity”.

The BSR alone issued their guidelines for the management of systemic lupus erythematosus (SLE) in 2018 (Gordon et al., 2018). For the statement “CRP low or normal unless infection”, the BSR gives an overall level of evidence of 2++ with a B grade of recommendation whereas they grade the statement “ESR correlates with active lupus” a 2+ and only a C grade of recommendation. “ESR is often raised in active SLE, but can also reflect persistent polyclonal hypergammaglobulinaemia, and is not a reliable marker of disease activity…. A significantly raised CRP is more likely to indicate infection, and patients with raised CRP will need therefore to be thoroughly screened for infection, given that infection is the commonest cause of death in lupus patients. In contrast, a raised ESR does not discriminate between active lupus and infection.” They recommend that CRP is tested at initial diagnosis and then every 1-3 months during active disease states. Once stabilized, then testing frequency can be every 6-12 months. They also state that CRP testing should be conducted on mothers with SLE during pregnancy, but they do not state the frequency of the testing during pregnancy.

**2012 Canadian Rheumatology Association (CRA) (Bykerk et al., 2012)**
The 2012 guidelines by the CRA titled Canadian Rheumatology Association Recommendations for Pharmacological Management of Rheumatoid Arthritis with Traditional and Biologic Disease-modifying Antirheumatic Drugs recommends (with Level II and Strength B) “the presence of the following poor prognostic features should be assessed at baseline and considered when making treatment decisions: RF positivity, anti-CCP positivity, functional limitation, high number of swollen and tender joints, early erosions, extraarticular features, high ESR or CRP”. They also recommend (with Level I and Strength A) “RA care providers should monitor disease activity as frequently as every 1 to 3 months in patients with active RA”. The disease activity should be monitored by a validated method, such as DAS28 or SDAI.

**2009 The National Collaborating Centre for Chronic Conditions (NCC-CC) (Conditions, 2009)**
The NCC-CC produced extensive guidelines for RA on behalf of the National Health Service of the UK in 2009. They clearly state in their guidelines that “in people with recent-onset active RA, measure C-reactive protein (CRP) and key components of disease activity (using a composite score such as DAS28) monthly until treatment has controlled the disease to a level previously agreed with the person with RA [Recommendation 35].” Regarding using CRP for prognostication, they state that “baseline CRP is a poor predictor of who will go on to develop RA”. Another recommendation [Recommendation 34] within the guidelines says to “measure CRP and key components of disease activity (using a composite score such as DAS28) regularly in people with RA to inform decision-making about increasing treatment to control disease [and] cautiously decreasing treatment when disease is controlled.”

**2009 The Rheumatoid Arthritis Working Group of The Royal Australian College of General Practitioners (RACGP)(March et al., 2009)**
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The RACGP released guidelines concerning the diagnosis and management of early rheumatoid arthritis for the National Health and Medical Research Council of Australia in 2009. They recommend (Grade A) the use of ESR and/or CRP. “For patients presenting with painful and swollen joints, GPs should support clinical examination with appropriate tests to exclude other forms of arthritis and other differential diagnoses, and to predict patients likely to progress to erosive disease. Base investigations should include erythrocyte sedimentation (ESR) and/or C-reactive protein (CRP)”. Prior to beginning treatment with an antirheumatic drug therapy, they also recommend CRP testing as good practice. ESR/CRP testing should be a part of basic therapy “to monitor for continuing efficacy” (Grade A). With a Grade B recommendation, “general practitioners should be involved in monitoring disease progression, response to treatment and comorbidities in conjunction with the treating rheumatologist and other members of the multidisciplinary team…. Arthritis activity should be assessed at least three times per year. Treatment should be adjusted to keep the swollen and tender joint count, and the CRP levels, as low as possible.”


NICE first issued the guidelines concerning irritable bowel syndrome (IBS) in 2008 with updates in 2015 and 2017. After initial assessment for IBS, they recommend ESR and CRP along with full blood count and antibody testing for celiac disease or tissue transglutaminase to exclude other possible diagnoses. They do not state anything concerning follow-up testing of either ESR or CRP.

<table>
<thead>
<tr>
<th>Society</th>
<th>Year</th>
<th>Condition</th>
<th>Test Preference (if stated)</th>
<th>Frequency of Testing (if stated)</th>
<th>Recommendations</th>
</tr>
</thead>
<tbody>
<tr>
<td>WHO</td>
<td>2018</td>
<td>General Inflammation</td>
<td>CRP</td>
<td>NS</td>
<td>CRP in either EIA or RDT assay is an essential diagnostic tool</td>
</tr>
<tr>
<td>NCCN</td>
<td>2018</td>
<td>Hodgkin Lymphoma</td>
<td>ESR</td>
<td>At least once within 6 months of diagnosis</td>
<td>Can be used in evaluating therapy</td>
</tr>
<tr>
<td>NCCN</td>
<td>2018</td>
<td>Castleman’s Disease</td>
<td>CRP and ESR</td>
<td>NS</td>
<td>“Essential” tests but does not explicitly state to use both</td>
</tr>
<tr>
<td>NCCN</td>
<td>2018</td>
<td>T-cell lymphomas</td>
<td>ESR</td>
<td>NS</td>
<td>“Useful” but does not state as requirement</td>
</tr>
<tr>
<td>ASCP (Choosing Wisely)</td>
<td>2015</td>
<td>General Inflammation</td>
<td>CRP</td>
<td>NS</td>
<td>Specifically recommends to NOT use ESR</td>
</tr>
<tr>
<td>EULAR</td>
<td>2009</td>
<td>Large Vessel Vasculitis</td>
<td>CRP and ESR</td>
<td>NS</td>
<td>Level of evidence is 3 with only a “C” strength of recommendation</td>
</tr>
<tr>
<td>EULAR</td>
<td>2013</td>
<td>Rheumatoid Arthritis</td>
<td>NS</td>
<td>NS</td>
<td>ESR is not useful in disease progression prediction</td>
</tr>
<tr>
<td>EULAR/ACR (Rheumatology)</td>
<td>2015</td>
<td>Polymyalgia Rheumatica</td>
<td>CRP and/or ESR</td>
<td>NS</td>
<td>At initial workup prior to prescription of therapy</td>
</tr>
<tr>
<td>EULAR</td>
<td>2016</td>
<td>Arthritis</td>
<td>CRP and ESR</td>
<td>1-3 months initially; 6-12 months later</td>
<td>Composite measure is best recommendation for monitoring disease</td>
</tr>
<tr>
<td>EULAR</td>
<td>2018</td>
<td>Large Vessel Vasculitis</td>
<td>CRP or ESR</td>
<td>NS</td>
<td>With respect to the use of imaging techniques, they recommend doing so in case of elevated CRP or ESR levels</td>
</tr>
<tr>
<td>ACR (Rheumatology)</td>
<td>2012</td>
<td>Rheumatoid Arthritis</td>
<td>CRP or ESR</td>
<td>NS</td>
<td>To be used as part of composite (such as DAS28)</td>
</tr>
<tr>
<td>ACR (Rheumatology)</td>
<td>2015</td>
<td>Rheumatoid Arthritis</td>
<td>CRP or ESR</td>
<td>At least once per year or more frequently for active disease</td>
<td>Preference not specifically stated, but CRP specifically mentioned in RA remission</td>
</tr>
<tr>
<td>ACR (Rheumatology)/SAA</td>
<td>2015</td>
<td>Ankylosing Spondylitis</td>
<td>CRP or ESR</td>
<td>Regular-interval use</td>
<td>“Very low-quality evidence”</td>
</tr>
</tbody>
</table>
### General Inflammation Testing AHS – G2155

<table>
<thead>
<tr>
<th>Source</th>
<th>Year</th>
<th>Condition</th>
<th>Test(s)</th>
<th>Frequency</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>AAFP</td>
<td>2013</td>
<td>Polymyalgia Rheumatica &amp; Giant Cell Arteritis</td>
<td>CRP or ESR</td>
<td>Follow-up lab with each clinic visit</td>
<td>For either PMR or GCA, CRP or ESR levels should be checked at each clinical visit</td>
</tr>
<tr>
<td>ACR (Radiology)</td>
<td>2014</td>
<td>Hodgkin Lymphoma</td>
<td>ESR</td>
<td>1-2 times per year, depending on variant</td>
<td>Does not mention CRP; limited data</td>
</tr>
<tr>
<td>BSR/BHPR</td>
<td>2010</td>
<td>Giant Cell Arteritis</td>
<td>CRP and/or ESR</td>
<td>Follow-up lab with each clinic visit</td>
<td>Their recommendation is a “consensus statement, level C”</td>
</tr>
<tr>
<td>BSR/BHPR</td>
<td>2010</td>
<td>Polymyalgia Rheumatica</td>
<td>CRP and/or ESR</td>
<td>At initial diagnosis; every 3 months during long-term steroid therapy</td>
<td>Generic recommendation (level B) of vigilant monitoring</td>
</tr>
<tr>
<td>BSR</td>
<td>2018</td>
<td>Systemic Lupus Erythematosus</td>
<td>CRP</td>
<td>At initial assessment; every 1-3 months during active disease; every 6-12 months during stable disease; during pregnancy</td>
<td>The frequency of CRP during pregnancy is not specified</td>
</tr>
<tr>
<td>CRA</td>
<td>2012</td>
<td>Rheumatoid Arthritis</td>
<td>CRP or ESR</td>
<td>At initial assessment prior to treatment; every 1-3 months during active disease</td>
<td>During active disease, CRP/ESR monitoring is part of composite testing, such as DAS28 or SDAI</td>
</tr>
<tr>
<td>NCC-CC</td>
<td>2009</td>
<td>Rheumatoid Arthritis</td>
<td>CRP</td>
<td>At initial assessment; monthly until disease is controlled</td>
<td>Recommendation 34: regular use of CRP and DAS28 to inform decision-making Recommendation 35: use of CRP/DAS28 for initial assessment and then monthly until disease is controlled</td>
</tr>
<tr>
<td>RACGP</td>
<td>2009</td>
<td>Rheumatoid Arthritis</td>
<td>CRP and/or ESR</td>
<td>At initial assessment; to monitor therapy efficacy; CRP testing at least every 4 months</td>
<td>For initial assessment, CRP and/or ESR should be used for diagnosing/assessing RA; however, in Recommendation 29, only CRP testing is specifically mentioned. Recommendation 29 is concerning disease monitoring.</td>
</tr>
<tr>
<td>NICE</td>
<td>2015</td>
<td>Irritable Bowel Disorders</td>
<td>CRP and ESR</td>
<td>NS</td>
<td>Only at initial assessment for exclusionary purposes</td>
</tr>
</tbody>
</table>

**Billing/Coding/Physician Documentation Information**

This policy may apply to the following codes. Inclusion of a code in this section does not guarantee that it will be reimbursed. For further information on reimbursement guidelines, please see Administrative Policies on the Blue Cross Blue Shield of North Carolina web site at www.bcbsnc.com. They are listed in the Category Search on the Medical Policy search page.

*Applicable service codes: 85651, 85652, 86140*
BCBSNC may request medical records for determination of medical necessity. When medical records are requested, letters of support and/or explanation are often useful, but are not sufficient documentation unless all specific information needed to make a medical necessity determination is included.

### Scientific Background and Reference Sources


Royal College of Physicians of London.


General Inflammation Testing


https://www.nice.org.uk/guidance/cg61


General Inflammation Testing AHS – G2155


Specialty Matched Consultant Advisory Panel review 02/2020

Policy Implementation/Update Information

<table>
<thead>
<tr>
<th>Date</th>
<th>Change Information</th>
</tr>
</thead>
<tbody>
<tr>
<td>1/1/19</td>
<td>New policy developed. BCBSNC will provide coverage for general inflammation testing when it is determined to be medically necessary because the medical criteria and guidelines are met. Medical Director review 1/1/2019. Policy noticed 1/1/2019 for effective date 4/1/2019. (an)</td>
</tr>
<tr>
<td>8/27/19</td>
<td>Policy guidelines and references updated. No change to policy statement. (eel)</td>
</tr>
<tr>
<td>10/1/19</td>
<td>Medical Director review 8/2019. Reviewed by Avalon 2nd Quarter 2019 CAB. (eel)</td>
</tr>
<tr>
<td>10/29/19</td>
<td>Wording in the Policy, When Covered, and/or Not Covered section(s) changed from Medical Necessity to Reimbursement language, where needed. (gm)</td>
</tr>
<tr>
<td>02/11/20</td>
<td>Reviewed by Avalon 4th Quarter CAB. No changes to policy. (eel)</td>
</tr>
<tr>
<td>03/10/20</td>
<td>Specialty Matched Consultant Advisory Panel 02/19/2020. No changes to policy. (eel)</td>
</tr>
</tbody>
</table>

Medical policy is not an authorization, certification, explanation of benefits or a contract. Benefits and eligibility are determined before medical guidelines and payment guidelines are applied. Benefits are determined by the group contract and subscriber certificate that is in effect at the time services are rendered. This document is solely provided for informational purposes only and is based on research of current medical literature and review of common medical practices in the treatment and diagnosis of disease. Medical practices and knowledge are constantly changing and BCBSNC reserves the right to review and revise its medical policies periodically.