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Corporate Medical Policy

Genetic Testing for Lipoprotein A Variant(s) as a Decision Aid for Aspirin Treatment and/or CVD Risk Assessment AHS – M2082

File Name:	genetic_testing_for_lipoprotein_a_variant(s)_as_a_decision_aid_for_aspirin_treatment_and_or_cvd_risk_assessment
Origination:	01/2019
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Description of Procedure or Service

Description

Lipoprotein(a) (Lp(a)) is a type of low-density lipoprotein (LDL) that consists of a cholesterol bearing LDL – like particle (apolipoprotein B-100) bound to the plasminogen-like glycoprotein apolipoprotein(a) (apo(a)) (Lu et al., 2015; Schmidt, Noureen, Kronenberg, & Utermann, 2016) and has been associated with increased risk for cardiovascular disease (CVD) (Tsimikas et al., 2018). Genetic variants of the Lp(a) gene, *LPA*, (rs3798220 and rs10455872) have been significantly associated with Lp(a) levels (Lu et al., 2015) and could serve as indicators of CVD risk (Lee et al., 2017). The genetic variant rs3798220 was found to have a higher risk for thrombosis and therefore may derive more benefit from the anti-thrombotic properties of aspirin (Chasman et al., 2009). As a result, testing for the rs3798220 variant has been proposed as a method of stratifying benefit from aspirin treatment (Shiffman, Slawsky, Fusfeld, Devlin, & Goss, 2012).

This policy only addresses the detection of specific genetic variants of Lp(a) as a decision aid for aspirin therapy or CVD risk.

For information on serum measurement of Lp(a) levels see medical policy titled Cardiovascular Disease Risk Assessment AHS – G2050.

For information on testing for salicylate resistance see medical policy titled Measurement of Thromboxane Metabolites for ASA Resistance AHS – G2107.

Related Policies
Cardiovascular Disease Risk Assessment AHS – G2050
Measurement of Thromboxane Metabolites for ASA Resistance AHS – G2107

******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

Genetic testing for lipoprotein A variant as a decision aid for aspirin treatment and/or CVD risk assessment is considered investigational. BCBSNC does not provide coverage for investigational services or procedures.

Genetic Testing for Lipoprotein A Variant(s) as a Decision Aid for Aspirin Treatment and/or CVD Risk Assessment AHS – M2082

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 Genetic Testing for Lipoprotein A Variant as a Decision Aid for Aspirin Treatment and/or CVD Risk Assessment is covered

Not applicable.

When Genetic Testing for Lipoprotein A Variant as a Decision Aid for Aspirin Treatment and/or CVD Risk Assessment is not covered

The use of genetic testing for the rs3798220 allele (including proprietary testing such as LPA-Aspirin Check® and Cardio IQ® LPA aspirin Genotype) is considered investigational in patients who are being considered for treatment with aspirin to reduce risk of cardiovascular events.

The use of genotyping of lipoprotein a (Lp(a)), including genetic testing for the rs3798220 single nucleotide polymorphism (SNP), the rs10455872 SNP, and/or the rs9457951 SNP, is considered investigational in all situations.

Policy Guidelines

Background

Cardiovascular disease (CVD) is a leading cause of morbidity and mortality; with over 11.5% of American adults (27.6 million) diagnosed with heart disease, it claims more lives each year than cancer and chronic lower respiratory disease combined (Benjamin et al., 2018). While progression of CVD is multifactorial, pathophysiological, and epidemiological, genetic studies have provided substantial evidence that Lp(a) is a causal risk factor contributing to CVD (Rosenson, Stein, & Durrington, 2020). Lp(a) is also elevated in heterozygous familial hypercholesterolemia, further increasing atherosclerotic CVD risk in that disease setting (Rosenson et al., 2020). The physiological role of Lp(a) is to bind and transport proinflammatory oxidized phospholipids in plasma, but its key relation to CVD has been the involvement in atherothrombosis, from the formation of an atherosclerotic plaque through inducing expression of inflammatory mediators and increasing foam formation, to thrombosis following plaque rupture (Fras, 2020). Independent of any other risk factors, Lp(a) was positively associated with increased risk of myocardial infarctions (MI) as well (Paré et al., 2019).

Since first described by Berg (1963) as a genetic trait increased in patients with coronary heart disease (Berg, Dahlen, & Frick, 1974), Lp(a) has been characterized as a type of LDL consisting of apolipoprotein B-100 covalently bound to apolipoprotein(a) (Steyrer et al., 1994). The plasma level and size of Lp(a) are regulated through strict genetic control by the apo(a) gene (*LPA*) on chromosome 6q26-27 with some influence from the *APOE* locus (Erhart et al., 2018; Lu et al., 2015; Moriarty, Varvel, Gordts, McConnell, & Tsimikas, 2017). The *LPA* gene is highly polymorphic based on the number of kringle (five cysteine-rich domains) IV (KIV) repeats, therefore encoding >40 apo(a) isoforms (Marcovina, Hobbs, & Albers, 1996) of varying molecular weights (Rosenson et al., 2020).

As it is genetically controlled, the concentration of Lp(a) is generally stable; correlates inversely with molecular size (smaller size correlating with higher serum levels); and is minimally influenced by age, weight and diet (Enkhmaa, Anuurad, & Berglund, 2016; Tregouet et al., 2009). Genetic variants of apo(a) have been found to have predictive value in coronary heart disease (CHD) (Anderson et al., 2013; Cairns et al., 2017; Helgadottir et al., 2012; Lee et al., 2017; Zekavat et al., 2018; Zewinger et al., 2017). Beyond CHD, genetically lowered Lp(a) is also associated with a lower risk of peripheral vascular disease, stroke, heart failure, and aortic stenosis (Emdin et al., 2016).

The prevalence and association of these genetic variants with apo(a) size and Lp(a) levels are highly variable and ethnicity-specific. Out of 118 single nucleotide polymorphisms (SNPs) identified, rs3798220 is most prevalent in Hispanics (42.38%), rs10455872 in Whites (14.27%), and rs9457951 in Blacks (32.92%). In Hispanics, the rs3798220 variant was associated with large isoforms and lower Lp(a) levels, but in Whites, this variant was associated with very small isoforms and higher Lp(a) levels (Lee et al., 2017). In a separate study that analyzed the relationship between Lp(a) concentration and risk of MI, Paré et al. (2019) found that the clinical use of Lp(a) concentrations for interventions to reduce MI risk would be useful among diverse populations, especially South Asians and Latin Americans, but not Africans or Arabs since there was an insignificant association between high Lp(a) concentration and MI risk in these populations (Paré et al., 2019).

Although its biology and pathophysiology is still incompletely understood (Tsimikas et al., 2018), Lp(a) is recognized as both atherogenic (Grainger et al., 1993; Hajjar, Gavish, Breslow, & Nachman, 1989; Helgadottir et al., 2012) and thrombogenic (Caplice et al., 2001; Marcovina & Koschinsky, 2003), possibly due to its structural homology with plasminogen (Hancock, Boffa, Marcovina, Nesheim, & Koschinsky, 2003; McLean et al., 1987). It is thought that Lp(a) could compete with plasminogen for fibrin binding, ultimately resulting in impaired fibrinolysis (Hervio, Durlach, Girard-Globa, & Angles-Cano, 1995).

A specific SNP in the *LPA* gene (rs3798220) results in an isoleucine-to-methionine substitution within the inactive protease domain, triggering a smaller number of kringle IV repeats, elevated Lp(a) levels, and a greater risk for CVD (Clarke et al., 2009; Helgadottir et al., 2012; Luke et al., 2007). This amino acid substitution (I4399M) has been studied for its effects on coagulation, fibrinolysis, and overall fibrin cloth structure (Scipione et al., 2017).

Carriers of either the rs3798220 or rs10455872 variant were found to have no difference in plasminogen concentration or clot lysis time (H. Wang et al., 2016). The I4399M variant was found to accelerate the coagulation of plasma clots *in vitro*, therefore suggesting that those with this variant may benefit from the anti-thrombotic properties of aspirin (Scipione et al., 2017). Further, a difference in phenotypic expression between different ethnic groups has been found. Among non-Caucasians, carriers of the rs3798220 variant had increased clot permeability and shorter lysis time, whereas among Caucasians, the trend was for decreased permeability and longer lysis time (Rowland et al., 2014). A correlation was identified between the I4399M variant and both elevated plasma Lp(a) levels and an increased risk of CHD; carriers of this variant in population studies also showed an increased benefit of aspirin therapy (Scipione et al., 2017).

Clinical Validity and Utility

The additional information obtained from the testing for Lp(a) genotype may aid physicians in better estimating the benefit/risk of aspirin therapy and therefore aid in deciding whether to prescribe aspirin for individual patients. *LPA* genotyping in the context of the aspirin use guidelines for primary prevention of CVD was found to be potentially cost-effective (Shiffman et al., 2012). However, traditional plasma-based hemostasis-thrombosis laboratory testing may be

more effective at managing venous thrombotic disease than a single DNA variant with a small effect size and no established mechanism linking aspirin with Lp(a) (Nagalla & Bray, 2016).

An analysis of the Women's Health Study comprised of a randomized trial of low-dose aspirin found that rs3798220 was associated with elevated Lp(a) and doubled CVD risk that could be attenuated by aspirin; carriers appeared to benefit more from aspirin than non-carriers (Chasman et al., 2009).

Ozkan, Ozcelik, Yildiz, and Budak (2019) have recently shown that Lp(a) gene polymorphisms play a role in the development of calcific aortic stenosis or calcific aortic valve disease (CAVD); blood samples were taken from 75 patients previously diagnosed with CAVD and 77 healthy controls. Results showed that "A significant association among smoking, elevated LDL level and creatinine, low albumin levels, Lp(a) level, rs10455872, and rs3798220 polymorphisms may be considered genetic risk factors for the development of calcific aortic stenosis" (Ozkan et al., 2019). However, even with a strong statistically significant relationship between the Lp(a) gene polymorphisms (rs10455872, and rs3798220) and CAVD, this study contained a relatively small sample size, suggesting that more research needs to be completed to validate these results. This research has been corroborated by Pechlivanis et al., who demonstrated that the rs10455872 SNP has a statistically significant association with coronary artery calcification, a predictor of coronary artery disease (Pechlivanis et al., 2020).

A large-scale study with 44,703 participants of European descent was completed, and a relationship was identified between two Lp(a) variants (rs10455872 and rs3798220) and aortic stenosis (AS) development (Chen et al., 2018). While a relationship between both of these Lp(a) variants has already been established in regards to circulating Lp(a) plasma levels and a high Lp(a) risk score, these data seem to confirm the association between these Lp(a) variants and valvular or cardiac disease events. Final results from this study showed that the participants with these two high-risk alleles had two times or more a chance of developing AS; however, it must be noted that participants with AS were on average older than the controls, meaning that some controls could still develop AS (Chen et al., 2018).

Mu-Han-Ha-Li et al. (2018) conducted a study with 1,863 Chinese patients with very high CVD risk (as identified on coronary angiography) to analyze the connection between Lp(a) levels and the risks of CVD and diabetes. Researchers concluded that a high number of *LPA* KIV type 2 repeats, and therefore lower serum Lp(a) levels, is associated with an increased risk of type 2 diabetes in a Chinese population with high CVD risk, suggesting that a large Lp(a) isoform size, and thus low Lp(a) concentration, can have a causal effect on type 2 diabetes (Mu-Han-Ha-Li, Zhai, Ling, & Gao, 2018). With this novel association, it becomes essential for genetic testing of *LPA* gene variants to not only follow up on CVD risk to assess benefit from aspirin therapy, but for the possible latter development of comorbidities like type 2 diabetes.

Additional researchers have identified a potential relationship between Lp(a) SNPs and a high inflammatory response that may result in an increased CVD risk in pregnant women; Tuten et al. (2019) analyzed data from 200 pregnant Turkish women, evaluating 14 different Lp(a) SNPs. Results found that two of the Lp(a) SNPs, rs9355296 and rs3798220, were identified as risk factors for preeclampsia, and that rs9355296 carriers reported higher vascular inflammatory rates (Tuten et al., 2019). These results suggest that specific Lp(a) variants may possibly be used as biomarkers for future cardiovascular events and inflammation.

Moreover, Wang and Zhang (2019) showed that high Lp(a) levels are associated with adverse clinicopathological features in prostate cancer patients. Patients with a prostate specific antigen (PSA) level ≥ 100 ng/ml had significantly higher Lp(a) levels; this was believed to be a result of compensatory mechanisms to chronic inflammation caused by tumor aggressiveness and invasion. The researchers also found that the percentage of metastases increased with elevation in Lp(a)

level, while body mass index (BMI) decreased with the Lp(a) elevation. The increased metastasis in the setting of high Lp(a) levels was believed to be due to facilitated formations of fibrin networks (apo(a), a part of Lp(a), has structural homologues to kringle IV in plasminogen, which normally induces fibrinolysis) and thrombus formation that allowed for cancer cell adhesion (F. M. Wang & Zhang, 2019). Genetic testing for Lp(a) may not only benefit CVD risk with aspirin therapy, but also implications with cancer development and treatment.

Guidelines and Recommendations

American Association of Clinical Endocrinologists (AACE) and American College of Endocrinology (ACE) (Jellinger et al., 2017)

The AACE/ACE published guidelines for the management of Dyslipidemia and Prevention of Cardiovascular Disease (Jellinger et al., 2017) which state:

"Testing for lipoprotein(a) is therefore not generally recommended, although it may provide useful information to ascribe risk in Caucasians with ASCVD, those with an unexplained family history of early ASCVD, or those with unknown family history such as adopted individuals."

Genetic screening for lipoprotein(a) variants is not mentioned.

National Heart, Lung, and Blood Institute (NHLBI) (Tsimikas et al., 2018)

The NHLBI published Working Group Recommendations to Reduce Lipoprotein(a)-Mediated Risk of Cardiovascular Disease and Aortic Stenosis (Tsimikas et al., 2018) which endorsed the European Society of Cardiology/European Atherosclerosis Society, Canadian Cardiovascular Society, and National Lipid Association Guidelines while making additional specific recommendations to facilitate basic, mechanistic, preclinical, and clinical research on Lp(a).

Genetic screening for lipoprotein(a) variants is not mentioned.

American College of Cardiology/American Heart Association (Goff et al., 2014; Lloyd-Jones et al., 2016)

The ACC and AHA issued joint guidelines (Goff et al., 2014) on the assessment of cardiovascular risk based on a systematic review conducted by an expert panel appointed by the National Heart, Lung, and Blood Institute. The panel noted that LPA was considered as a risk predictor, but its contribution to risk assessment "awaits further consideration at a later time."

The ACC Expert Consensus Decision Pathway on the Role of Non-Statin Therapies for LDL-Cholesterol Lowering in the Management of Atherosclerotic Cardiovascular Disease Risk: A Report of the American College of Cardiology Task Force on Clinical Expert Consensus Documents (Lloyd-Jones et al., 2016) refer to elevated lipoprotein(a) as an comorbidity that increased ASCVD risk.

Genetic screening for lipoprotein(a) variants is not mentioned.

The National Lipid Association (NLA) (Jacobson et al., 2015; Wilson et al., 2019)

The NLA considers Lp(a) to be an important clinical biomarker and risk factor for atherosclerotic cardiovascular disease. It is stated that a main obstacle towards the clinical use of Lp(a) is that measurements and various other targeted levels have not yet been standardized in the industry; for example, several of the available assays are reporting results in differing units, such as in mass instead of concentration (Wilson et al., 2019). Based on current data, Wilson et al. (2019) has stated that Lp(a) testing in clinical practice is reasonable for select individuals with the qualifications listed below:

- Adults older than 20 years with a family history of premature atherosclerotic cardiovascular disease (ASCVD)
- "Individuals with premature ASCVD (55y of age in men; 65y of age in women), particularly in the absence of traditional risk factors
- Individuals at very-high-risk of ASCVD to better define those who are more likely to benefit from PCSK9 inhibitor therapy"

Wilson et al. (2019) also stated that Lp(a) testing may be reasonable in patients with:

- "Intermediate (7.5%–19.9%) 10-y ASCVD risk when the decision to use a statin is uncertain, to improve risk stratification in primary prevention
- Borderline (5%–7.4%) 10-y ASCVD risk when the decision to use a statin is uncertain, to improve risk stratification in primary prevention
- Less-than-anticipated LDL-C lowering, despite good adherence to LDL-C lowering therapy
- A family history of elevated Lp(a)
- Calcific valvular aortic stenosis
- Recurrent or progressive ASCVD, despite optimal lipid-lowering therapy"

The NLA has previously published recommendations for the Patient-Centered Management of Dyslipidemia (Jacobson et al., 2015) which lists Lipoprotein (a) >50mg/dL as an additional risk indicator that physicians could consider, partially in patients with moderate risk.

Genetic screening for Lp(a) variants is not mentioned in the NLA's official guidelines.

The European Society for Cardiology (ESC) and European Atherosclerosis Society (EAS) (Catapano et al., 2016; Nordestgaard et al., 2010)

The ESC and EAS published Guidelines for the Management of Dyslipidemias (Catapano et al., 2016) which recommend: "Plasma Lp(a) is not recommended for risk screening in the general population; however, Lp(a) measurement should be systematically considered in people with high

CVD risk or a strong family history of premature atherothrombotic disease. The risk is regarded as significant when Lp(a) is above the 80th percentile (50 mg/dL). Including Lp(a) in risk evaluation has been shown to give a correct reclassification and should be considered in patients on the borderline between high and moderate risk."

Genetic screening for Lp(a) variants is not mentioned.

American Society for Clinical Pathology (ASCP)/Choosing Wisely (ASCP, 2016)

The American Society for Clinical Pathology (ASCP, 2016), as part of the Choosing Wisely Campaign, recommended that "a standard lipid profile includes total cholesterol, low-density lipoprotein (LDL) cholesterol, high-density lipoprotein (HDL) cholesterol, and triglycerides. These lipids are carried within lipoprotein particles that are heterogeneous in size, density, charge, core lipid composition, specific apolipoproteins, and function. A variety of lipoprotein assays have been developed that subfractionate lipoprotein particles according to some of these properties, such as size, density, or charge. However, selection of these lipoprotein assays for improving assessment of risk of cardiovascular disease and guiding lipid-lowering therapies should be on an individualized basis for intermediate to high-risk patients only. They are not indicated for population based cardiovascular risk screening."

Genetic screening for lipoprotein(a) variants is not mentioned.

HEART UK Medical, Scientific, and Research Committee (Cegla et al., 2019)

HEART UK published guidelines for Lp(a) measurement in specific adult populations.

On genetic testing for Lp(a) levels, the guideline also noted, "Genetic testing for SNPs associated with serum Lp(a) levels is not currently advocated for in routine clinical practice" (Cegla et al., 2019).

U.S. Preventive Services Task Force (USPSTF) (Guirguis-Blake, Evans, Senger, O'Connor, & Whitlock, 2016)

U.S. Preventive Services Task Force (USPSTF) guidelines from 2016 recommendation for aspirin do not mention lipoprotein(a) or genetic screening for lipoprotein (a).

Applicable Federal Regulations

The LPA-Aspirin Check® detects the presence of the rs3798220 allele and is considered a laboratory developed test (LDT); this test is developed, validated, and performed by individual laboratories.

The Cardio IQ® LPA Aspirin Genotype test is able to detect individuals who are at risk of high plasma Lp(a) levels, which may suggest an increased risk of cardiovascular events; this assay may also assist in determining if the patient's cardiovascular disease risk may be lowered by low-dose aspirin therapy (Quest_Diagnostics, 2019). This test has not been cleared or approved by the FDA.

A search of the FDA Device database on 09/27/2020 for "lipoprotein a" yielded 35 results. Additionally, many labs have developed specific tests that they must validate and perform in house. These laboratory-developed tests (LDTs) are regulated by the Centers for Medicare and Medicaid (CMS) as high-complexity tests under the Clinical Laboratory Improvement Amendments of 1988 (CLIA '88). As an LDT, the U. S. Food and Drug Administration has not approved or cleared this test; however, FDA clearance or approval is not currently required for clinical use.

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: 81479

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

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Policy Implementation/Update Information

1/1/2019 New policy developed. BCBSNC will not provide coverage for genetic testing for lipoprotein A variant as a decision aid for aspirin treatment because it is considered investigational. BCBSNC does not provide coverage for investigational services or procedures. Medical Director review 1/1/2019. Policy noticed 1/1/2019 for effective date 4/1/2019. (jd)

For the policy titled: Genetic Testing for Lipoprotein A Variant(s) as a Decision Aid for Aspirin Treatment and/or CVD Risk Assessment

4/1/2019 Policy title changed throughout to reflect the addition of Lp(A) testing for CVD; description section, policy guidelines and references updated. Related Policies section added. Added 2nd policy statement "The use of genotyping of lipoprotein a (Lp(a)), including genetic testing for the rs3798220 single nucleotide polymorphism (SNP), the rs10455872 SNP, and/or the rs9457951 SNP, is considered investigational", to the When Not Covered section. Policy noticed 4/1/19, effective 6/1/19. Medical Director review 4/2019. (jd)

10/29/19 No change to policy statements. (hb)

2/11/20 Annual review by Avalon 4th Quarter 2019 CAB. No revisions and no change in policy intent. Medical Director review 12/2019. (jd)

4/28/20 Specialty Matched Consultant Advisory Panel review 4/2020. Medical Director review 4/2020. (jd)

2/9/21 Annual review by Avalon 4th Quarter 2020 CAB. Minor updates to description,policy guidelines and references. Medical Director review 1/2021. (jd)