January 29, 2019

Qualigen, Inc.
Wajdi Abdul-Ahad
Vice President, Assay Development
2042 Corte Del Nogal
Carlsbad, CA 92011

Re: K182521
Trade/Device Name: FastPack IP Sex Hormone Binding Globulin Immunoassay
Regulation Number: 21 CFR 862.1680
Regulation Name: Testosterone test system
Regulatory Class: Class I, reserved
Product Code: CDZ
Dated: December 20, 2018
Received: December 26, 2018

Dear Wajdi Abdul-Ahad:

We have reviewed your Section 510(k) premarket notification of intent to market the device referenced above and have determined the device is substantially equivalent (for the indications for use stated in the enclosure) to legally marketed predicate devices marketed in interstate commerce prior to May 28, 1976, the enactment date of the Medical Device Amendments, or to devices that have been reclassified in accordance with the provisions of the Federal Food, Drug, and Cosmetic Act (Act) that do not require approval of a premarket approval application (PMA). You may, therefore, market the device, subject to the general controls provisions of the Act. Although this letter refers to your product as a device, please be aware that some cleared products may instead be combination products. The 510(k) Premarket Notification Database located at https://www.accessdata.fda.gov/scripts/cdrh/cfdocs/cfpmn/pmn.cfm identifies combination product submissions. The general controls provisions of the Act include requirements for annual registration, listing of devices, good manufacturing practice, labeling, and prohibitions against misbranding and adulteration. Please note: CDRH does not evaluate information related to contract liability warranties. We remind you, however, that device labeling must be truthful and not misleading.

If your device is classified (see above) into either class II (Special Controls) or class III (PMA), it may be subject to additional controls. Existing major regulations affecting your device can be found in the Code of Federal Regulations, Title 21, Parts 800 to 898. In addition, FDA may publish further announcements concerning your device in the Federal Register.

Please be advised that FDA's issuance of a substantial equivalence determination does not mean that FDA has made a determination that your device complies with other requirements of the Act or any Federal statutes and regulations administered by other Federal agencies. You must comply with all the Act's requirements, including, but not limited to: registration and listing (21 CFR Part 807); labeling (21 CFR Part 801 and Part 809); medical device reporting (reporting of medical device-related adverse events) (21 CFR 803) for devices or postmarketing safety reporting (21 CFR 4, Subpart B) for combination products (see https://www.fda.gov/CombinationProducts/GuidanceRegulatoryInformation/ucm597488.htm); good manufacturing practice requirements as set forth in the quality systems (QS) regulation (21 CFR Part 820) for devices or current good manufacturing practices (21 CFR 4, Subpart A) for combination products; and, if applicable, the electronic product radiation control provisions (Sections 531-542 of the Act); 21 CFR 1000-1050.

Also, please note the regulation entitled, "Misbranding by reference to premarket notification" (21 CFR Part 807.97). For questions regarding the reporting of adverse events under the MDR regulation (21 CFR Part 803), please go to http://www.fda.gov/MedicalDevices/Safety/ReportaProblem/default.htm.

For comprehensive regulatory information about medical devices and radiation-emitting products, including information about labeling regulations, please see Device Advice (https://www.fda.gov/MedicalDevices/DeviceRegulationandGuidance/) and CDRH Learn (http://www.fda.gov/Training/CDRHLearn). Additionally, you may contact the Division of Industry and Consumer Education (DICE) to ask a question about a specific regulatory topic. See the DICE website (http://www.fda.gov/DICE) for more information or contact DICE by email (DICE@fda.hhs.gov) or phone (1-800-638-2041 or 301-796-7100).

Sincerely,

Kellie B. Kelm -S

for Courtney H. Lias, Ph.D.
Director
Division of Chemistry and Toxicology Devices
Office of In Vitro Diagnostics
and Radiological Health
Center for Devices and Radiological Health

Enclosure

DEPARTMENT OF HEALTH AND HUMAN SERVICES
Food and Drug Administration

Indications for Use

Form Approved: OMB No. 0910-0120
Expiration Date: 06/30/2020
See PRA Statement below.

510(k) Number *(if known)*
K182521

Device Name
FastPack® IP Sex Hormone Binding Globulin Immunoassay

Indications for Use *(Describe)*

FastPack® IP SHBG is a chemiluminescent immunoassay intended for the quantitative determination of Sex Hormone Binding Globulin in human serum and plasma on the FastPack® System. The FastPack® IP SHBG assay is intended for use as an aid in the diagnosis of androgen disorders.

Type of Use *(Select one or both, as applicable)*

☒ Prescription Use (Part 21 CFR 801 Subpart D) ☐ Over-The-Counter Use (21 CFR 801 Subpart C)

CONTINUE ON A SEPARATE PAGE IF NEEDED.

510(k) SUMMARY

This 510(k) Summary information is submitted in accordance with the requirements of 21 CFR § 807.92.

510(k) Number: K182521

Submitter:

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Device Identification

Trade Names: FastPack® IP Sex Hormone Binding Globulin Immunoassay

Common Names: Sex Hormone Binding Globulin Assay

Classification names: Immunological Test Systems

Classifications: Class I, reserved (assay)

Panel: Chemistry (75)

Product Codes: CDZ – SHBG Assay

Regulation Numbers: 21 CFR § 862.1680 – Testosterone test system – Class I, reserved

Devices to Which Substantial Equivalence is Claimed

Access Sex Hormone Binding Globulin assay
Beckman Coulter, Inc.
250 S. Kraemer Blvd.
Brea, CA 92821
K083867

Device Description

The FastPack® IP Sex Hormone Binding Globulin Immunoassay employs a sandwich immunoassay principle. Endogenous SHBG in a patient sample, calibrator, or control is dispensed into a FastPack® reagent pack. In the reagent pack, the sample binds with a monoclonal anti-SHBG antibody covalently linked to alkaline phosphatase (ALP) and a different monoclonal anti-SHBG antibody linked to biotin which will bind to streptavidin coated paramagnetic particles (PMP). After incubation, washing steps (using a Tris buffer containing detergents) occur to separate bound from unbound anti-SHBG monoclonal antibody-ALP, a chemiluminogenic substrate mixture is added to the system. This mixture contains indoxyl-3-phosphate, a substrate for ALP, and lucigenin (N,N'-dimethyl-9,9'-biacridinium dinitrate). ALP dephosphorylates indoxyl-3-phosphate to indol-3-ol, which subsequently undergoes oxidation. As a result, lucigenin is reduced to form a dioxetane structure that is cleaved to yield N-methylacridone. This compound produces a sustained luminescent glow following excitation. The raw relative luminescence units (RLUs) generated are measured by a photomultiplier tube in the FastPack® Analyzer and are directly proportional to the concentration of SHBG in the sample. The entire reaction sequence takes place at 37 ± 0.5 °C and is protected from external light.

Intended Use

FastPack® IP SHBG is a chemiluminescent immunoassay intended for the quantitative determination of Sex Hormone Binding Globulin in human serum and plasma on the FastPack® System. The FastPack® IP SHBG assay is intended for use as an aid in the diagnosis of androgen disorders.

Comparison of new device to predicate device

Similarities between FastPack® and Beckman Coulter Access 2 Assays

CHARACTERISTIC	Qualigen FastPack® IP Sex Hormone Binding Globulin Immunoassay	Beckman Coulter Sex Hormone Binding Globulin K083867
Intended Use/ Indications for Use	FastPack® IP SHBG is a chemiluminescent immunoassay intended for the quantitative determination of Sex Hormone Binding Globulin in human serum and plasma on the FastPack® System. The FastPack® IP SHBG assay is intended for use as an aid in the diagnosis of androgen disorders.	The Access SHBG assay is a paramagnetic particle, chemiluminescent immunoassay for the quantitative determination of Sex Hormone Binding Globulin levels in human serum and plasma using the Access Immunoassay Systems. The Access Sex Hormone Binding Globulin assay is indicated for use in the assessment of androgen disorders.
Assay format	Paramagnetic particle, chemiluminescent, two-site sandwich immunoassay employing specific monoclonal antibodies	Same
Assay procedure	Automated	Same
Components	Mouse monoclonal antibody against SHBG in the capture phase and a mouse monoclonal anti-SHBG antibody conjugated to alkaline phosphatase in the signal phase.	Same
Sample Type	Serum or lithium-heparin plasma	Same
Sample Preparation	Standard processing for serum or plasma	Same
Interpretation of Results	Standard Curve	Same
Reagent Storage Temperature	2-8 ºC	Same
Testing Environment	Professional use	Same

Precision (% CV)	Within-run: ≤ 10% Between-run: ≤ 8% Between-day: ≤ 8%	≤ 5.5%
Linearity	Assay linear from LOQ (0.80 nmol/L) to 174 nmol/L	Assay linear from 0.33 - 200 nmol/L
Interfering Substances/Specificity	No interference with acetaminophen (10 mg/dL), acetylsalicylic acid (80 mg/dL), alpha-fetoprotein (500 µg/L), conjugated bilirubin (40 mg/dL), unconjugated bilirubin (30 mg/dL), d-biotin (0.2 mg/dL), cortisol (10 mg/dL), 11-deoxycortisol (0.5 mg/dL), 5-∝-dihydrotestosterone (2 mg/dL), hemoglobin (1.0 g/dL), heparin (10,000 U/dL), human serum albumin (8 g/dL), ibuprofen (600 mg/dL), estradiol (4 mg/dL), GAS6 (250 µg/L), laminin (6000 µg/L), Protein S (30 mg/L), testosterone (2.5 mg/dL), thyroglobulin (300 µg/L), thyroxine-binding globulin (20 mg/dL), transferrin (0.5 g/dL), and triglycerides/Intralipid (1000 mg/dL)	No interferences at similar concentrations of the same substances
Comparative Testing vs Established Methods	*FastPack® vs. Access* N = 158 Range of observations: 5.7 to 176.0 nmol/L <u>Passing-Bablok regression:</u> Slope (95% CI): 0.993 (0.967-1.019) y (95% CI): -0.614 (-2.21 to 0.982) R = 0.985 R^2 = 0.971	*Beckman Access vs. Immulite* N = 158 Range of observations: 5.7 – 184.5 nmol/L <u>Deming regression:</u> Slope (95% CI): 1.09 (1.06–1.12) y (95% CI): 1.84 (0.54 – 3.00) R^2 = 0.94
Expected Values/Reference Intervals	Males (13-50 years): 9.4-61.8 Males (≥ 50 years): 13.0-86.4 Females (12-46 years): 9.2-134.4 Females (> 46 years): 12.2-121.2	Males (20-50 years): 13.3-89.5 nmol/L Females (20-49 years): 18.2-135.5 nmol/L Post-menopausal females (≥50 years): 16.8-125.2 nmol/L

Differences between FastPack® and Beckman Access Sex Hormone Binding Globulin

CHARACTERISTIC	Qualigen FastPack® IP Sex Hormone Binding Globulin Immunoassay	Beckman Coulter Sex Hormone Binding Globulin K083867
Approximate assay time	8 minutes	~28 minutes (first result)
Traceability	Traceable to the WHO 082/266 reference which serves as the Primary Reference Material	Traceable to the WHO 95/560 reference

Performance Summary

Precision

Precision was evaluated following the CLSI EP5-A3 guidance. Seven serum patient samples with concentrations of ~ 5 to ~ 150 nmol/L SHBG were tested in duplicate determinations in each of two runs per day on each of three FastPack® reagent lots, one FastPack® analyzer per reagent lot (total of three Analyzers), one FastPack® Calibrator per reagent lot (total of three Calibrator lots) over a period of 20 non-consecutive days to yield 240 replicate determinations of each sample. Within-run, between-run, between-day, and total imprecision were calculated using a fully nested 2-way random factor analysis of variance (ANOVA) model. The following three tables present the results by combination of reagent lot, analyzer, and calibrator lot:

Reagent lot 1, analyzer 1, calibrator lot 1

		Within-Run		Between-Run		Between-Day		Total	
Sample	Mean nmol/L	SD	%CV	SD	%CV	SD	%CV	SD	%CV
1	4.85	0.27	5.55	0.00	0.00	0.21	4.37	0.34	7.06
2	12.56	0.60	4.82	0.68	5.46	0.28	2.19	0.60	4.82
3	25.59	1.40	5.46	1.83	7.14	0.87	3.40	1.40	5.46
4	59.49	3.67	6.16	1.80	3.03	2.95	4.96	3.67	6.16
5	91.33	5.99	6.56	7.12	7.79	0.00	0.00	5.99	6.56
6	102.26	7.11	6.95	3.85	3.76	4.76	4.66	7.11	6.95
7	154.79	4.24	2.74	0.62	0.40	2.51	1.62	4.96	3.21

Reagent lot 2, analyzer 2, calibrator lot 2

		Within-Run		Between-Run		Between-Day		Total	
Sample	Mean nmol/L	SD	%CV	SD	%CV	SD	%CV	SD	%CV
1	5.02	4.88	4.88	0.00	0.00	0.16	3.20	0.29	5.83
2	16.74	0.74	4.40	0.89	5.29	0.88	5.24	1.45	8.65
3	29.97	1.58	5.27	1.97	6.56	0.37	1.25	2.55	8.51
4	63.53	2.99	4.71	3.36	5.29	2.57	4.04	5.18	8.15
5	94.47	7.31	7.74	5.33	5.64	4.44	4.70	10.07	10.66
6	107.81	8.31	7.70	4.59	4.26	8.03	7.44	12.43	11.53
7	150.43	4.16	4.16	0.00	0.00	4.28	2.85	7.58	5.04

Reagent lot 3, analyzer 3, calibrator lot 3

		Within-Run		Between-Run		Between-Day		Total	
Sample	Mean nmol/L	SD	%CV	SD	%CV	SD	%CV	SD	%CV
1	4.90	0.21	4.2	0.0	0.0	0.1	2.0	0.2	4.7
2	14.26	0.67	4.69	0.51	3.56	0.45	3.13	0.95	6.67
3	25.47	1.22	4.78	1.75	6.86	0.91	3.58	2.32	9.10
4	58.56	3.30	5.64	4.22	7.21	2.25	3.85	5.81	9.93
5	91.40	8.78	9.60	3.70	4.05	5.53	6.05	11.02	12.05
6	105.25	7.42	7.05	5.21	4.95	0.00	0.00	9.07	8.61
7	148.44	5.04	3.4	0.8	0.5	3.0	2.0	5.9	4.0

Limits of blank, detection, and quantitation

The limit of blank (LOB, the highest measurement likely to be observed for a blank sample), limit of detection (LOD, the lowest amount of analyte in a sample that can be detected with type I and II error rates set to 5%), and limit of quantitation (LOQ, the lowest amount of analyte in a sample that can be reliably detected) were determined according to CLSI EP17-A2 for the FastPack® IP Sex Hormone Binding Globulin Immunoassay. In this study, the limit of blank was determined from 180 replicate determinations of a blank sample tested on six different FastPack® analyzers using three reagent lots. Raw RLUs from the assays were converted to apparent nmol/L based on the calibration curve for each assay. The LOB was determined as the 171.5th rank of the sorted distribution of values. This value was 0.08 nmol/L SHBG.

The LOD was estimated from 180 replicate determinations of four low level samples. Per the CLSI EP17-A2 guideline, the parametric LOD calculation was utilized and the LOD was 0.20 nmol/L SHBG.

The LOQ was determined as the lowest sample which provided ≤ 20% CV the value was 0.80 nmol/L SHBG.

Linearity

Linearity was determined following CLSI EP6-A: Evaluation of the Linearity of Quantitative Measurement Procedures: a Statistical Approach: Approved Guideline. A high patient sample was intermixed with a low sample to generate 11 concentration levels each tested in quadruplicate determinations. Linear results were compared to 2nd and 3rd order polynomial fits against a pre-specified allowable error. The linearity range was found to extend from the LOQ (0.80 nmol/L) to 174 nmol/L.

Interferences

The effect of endogenous interferences on quantification of SHBG was investigated by preparation of two serum samples with differing SHBG concentrations (a low and high) with known concentrations of conjugated bilirubin, unconjugated bilirubin, hemoglobin, lipids, and d-biotin. The value obtained for the sample with each interfering substance was compared to the value obtained for the sample without the interfering substance and the percentage recovery in nmol/L SHBG determined. These compounds did not show interference at the levels indicated in the following table. Higher levels may cause interference.

Compound	Highest level demonstrating no interference
Conjugated Bilirubin	40 mg/dL
Unconjugated Bilirubin	30 mg/dL
Hemoglobin	1.0 g/dL
Lipid	1000 mg/dL
d-Biotin	0.2 mg/dL

The effect of potentially cross-reacting substances on quantification of SHBG was investigated. Again, two serum samples with differing SHBG concentrations (a low and high) with known concentrations of spiked cross-reactants were prepared. The value obtained for the sample with each potentially cross-reacting substance was compared to the value obtained for the sample without the substance and the percentage recovery in nmol/L SHBG determined. These compounds did not show cross-reactivity at the levels indicated in the following table. Higher levels may cause cross-reaction.

Compound	Highest level demonstrating no cross-reaction
Transferrin	0.5 g/dL
Heparin	10,000 U/dL
Low Molecular Weight Heparin (LMWH)	0.6 U/dL
Ibuprofen	60 mg/dL
Human Albumin	Endogenous in samples + 8.0 g/dL
Human IgG	1.0 g/dL
Thyroxine Binding Globulin (TBG)	20 mg/dL
Thyroglobulin	300 µg/L
Testosterone	2.5. mg/dL
Laminin	6,000 µg/L
GAS6	250 µg/L
Protein S	30 mg/L
Estradiol	4.0 mg/dL
11-deoxycortisol	0.5 mg/dL
5α-dihydrotestosterone	2.0 mg/dL
Cortisol	10 mg/dL
AFP	500 µg/L
Acetaminophen	10 mg/dL
Acetylsalicylic acid	80 mg/dL

Rheumatoid factor at up to 1000 IU/mL and human anti-mouse IgG at up to 4 µg/mL do not cross-react in the FastPack® IP Sex Hormone Binding Globulin Immunoassay.

Additionally, six known heterophile samples did not generate detectable interference in the assay.

Serum and plasma equivalence

Blood collections were obtained from 54 volunteers and processed in parallel to serum and lithium-heparin plasma. Measurements in the FastPack® IP Sex Hormone Binding Globulin Immunoassay were compared via Passing-Bablok regression and indicated equivalence between the matrices.

Parameter	Result
N compared	54
Range of observations, nmol/L	Serum: 5.7 – 174.5 Lithium-Heparin Plasma: 7.1 – 175.1
Absolute bias, nmol/L	1.117
% Bias	1.928
Passing Bablok regression results	
Slope (95% CI)	0.960 (0.920-1.00)
y-intercept (95% CI)	1.859 (-0.89 to 4.61)
R	0.990
R^2	0.979

Expected Values/Reference Intervals

Serum samples from N=613 male (n=304) and female (n=309) apparently healthy individuals with no known pre-existing endocrine disorders were acquired and assayed in singlet determinations. Analysis of the data relied upon determination of the non-parametric 2.5th-97.5th (central 95%) percentiles of the distributions within four reference partitions. The FastPack® IP Sex Hormone Binding Globulin reference intervals are defined below:

Partition	N	Median (nmol/L)	Reference Interval (nmol/L)
Males 13 – 50 years	149	26.6	9.4 – 61.8
Males > 50 years	155	35.9	13.0 – 86.4
Females 12 – 46 years	151	39.6	9.2 – 134.4
Females > 46 years	158	49.8	12.2 – 121.2

Method Comparison

Human serum samples were tested with the FastPack® IP Sex Hormone Binding Globulin Immunoassay and the obtained results were compared to the predicate method. A total of

158 samples ranging from 5.7 – 176.0 nmol/L were tested in both assays. The FastPack® IP Sex Hormone Binding Globulin Immunoassay correlated well with the predicate method with correlation coefficient (R) of 0.985, slope = 0.993, and y-intercept = -0.614 nmol/L.

Parameter	Result
Slope (95% CI)	0.993 (0.967-1.019)
y-intercept (95% CI)	-0.614 (-2.21 to 0.982)
R^2 (95% CI)	0.971
R (95% CI)	0.985

SUMMARY

The information provided in this pre-market notification indicates that the FastPack® IP Sex Hormone Binding Globulin Immunoassay is substantially equivalent to the stated predicate device. The information further indicates that the FastPack® IP Sex Hormone Binding Globulin Immunoassay is safe and effective for its stated intended use.