

A Proposed Method for Prediction of Membranous Nephropathy Disease

K.Padmavathi, A.V.Senthilkumar

ABSTRACT: *Kidney disease is the most prevailing problem in today's world. Gathering knowledge through data analyzing is called data mining which can be widely used in healthcare industry. Medical data mining plays an important role in prediction of the disease. Nephrotic disease is the most challenging disease in day to day life. Membranous nephropathy disease is caused by the immune system of the body. An antibody called PLA2R is found in the kidney. When this antibody reacts with the antigen it causes the disease MN. Patients can lose 10-20gm of protein per day and experience severe disability. Membranous nephropathy is of two types, primary MN and secondary MN. Prediction of PLA2R antibodies plays an important role in Membranous Nephropathy. In this paper it is proposed to analyze the PLA2R antibodies in the patient over a period of time. Based upon the analysis of primary MN prediction can be done. Hypothesis is established in monitoring the PLA2R antibody and it will help in diagnosis and subsequent treatment of the disease Membranous Nephropathy (MN).*

KEYWORDS: *Membranous Nephropathy (MN), anti-PLA2R, Nephrotic Syndrome, Kaplan Meier method.*

I. INTRODUCTION

Kidney disease is one of the most common of the specific types of disease has been in day to day world. The immune system normally creates an antibodies to create an immune complex. Antigen that causes the production of antibodies which in turn kill the harmful bacteria in the blood stream. Immune complex occur when an antibody attaches to antigen. Both antigen and antibodies are called immune complex. Membranous nephropathy is the outcome of the immune complexes on glomerular disease[1]. Secondary infections like Cancer, Hepatitis B and C will lead to Secondary MN. Monitoring the antibody anti-PLA2R helps us to predict the disease MN. From the analysis, it is diagnosed that the disease is caused by PLA2R antibodies. The anti-PLA2R antibody attaches to the phospholipase A2 receptor (the antigen) and cause the disease membranous nephropathy. Another antibody called anti-THSD7A is found in some patients with primary MN[3]. In the outcome of the membranous nephropathy disease it is stated that only small number of data has been recorded for large number of patients. The patient's condition was analyzed through the biopsies database. The databases for this glomerular disease was not systematic to estimate the posttransplant Membranous Nephropathy disease. The Main scientific presentations were proteinuria and graft dysfunction. The presence of antibodies anti-PLA2R was not estimated. In this research work it is proposed to analyze the PLA2R antibodies over a period of time.

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Hypothesis method is used to analyze this PLA2R antibodies. Monitoring the PLA2R antibodies helps in appropriate tuning of the dosage and selection of drug in different times which had a significant improvement in diagnosis and treatment. Prediction of the disease was done using the significant value from the hypothesis method.

II. LITERATURE REVIEW

Artur Q. B. da Silva et. Al.[2018] examined that there are restricted data about clinical creation and consequences of post move results of post transplant loyalty looks like human membranous nephropathy MN and few reports incorporate countless patients. This was a review companion incorporating grown-up patients with post transplant MN transplanted somewhere in the range of 1983 and 2015 out of a solitary focus. Just patients with histological analysis of MN in kidney unions were incorporated. Therapeutic and research center course of action, histological outcomes, taking care of and results were thorough. Patients were essentially male (58.5%), with a mean time of 49.4 give or take 13.2 years; 15 were estimated as standard principle MN, 3 were class V lupus nephritis, 14 were considered as once more cases, 7 auxiliary and 7 essential MN and 9 cases were viewed as essential however it was impractical to recognize once more MN and repeat. Primary logical introductions were proteinuria (75.6%) and join brokenness (34.1%). Most patients with fundamental repetitive and anew essential MN were submitted to changes in upkeep immunosuppressive routine however standard technique; 31 patients offered fractional or complete decrease, and glomerulopathy developed not to power unite and tolerant perseverance.

Rajiv D. Poduval, Michelle A. Josephson, and Basit Javid[3] Membranous nephropathy MN is one of the basic glomerular illnesses analyzed in transplanted kidneys. The effect of post transplantation MN on the hazard for join misfortune and long haul unite result isn't characterized plainly. Post transplantation MN remains a puzzle, with a high level of changeability in the ailment course and announced results. The advantage for analysis and auxiliary reasons for with specific diseases, for example, hepatitis B and C infection syphilis, fundamental lupus Erythematosis and danger in these patients ought to be assessed cautiously on the grounds that distinguishing proof of such basic components may have significant ramifications for unite and patient survival [4]. The authors gratefully acknowledge the contributions of the following individuals who participated in discussions that shaped the content of this article: Kirk Campbell; Puneet Garg; Ellie Kelepouris; Richard Lafayette; and James. Tripti Singh et Al[5] [2018] expressed that Patients with MN have higher rate of intense dismissal after kidney transplant however have comparative 10-year allograft survival in contrast with the other



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glomerular ailments like IgAN, FSGS and LN.

T. S. Dabadea, J. P. Grande b, S. M. Norbyb, F. C. Ferverza band F. G. Cosio c[6] viewed that Membranous Nephropathy MN is a common cause of nephrotic syndrome in adults and progresses MN can recur after kidney transplantation causing proteinuria, allograft dysfunction and graft failure.

The author assessed the incidence of MN recurrence utilizing surveillance.. Glomerular diseases were the cause of kidney failure in 28% of patients and 23 (2%) had idiopathic MN .

Maurizio Salvadori [7] investigated that Rituximab is a monoclonal immune response that has been utilized in a few preliminaries and seems ready to actuate reduction of nephrotic disorder in 60% of patients (GEMRITUX preliminary) with comparable hazard profile. The KDIGO Clinical Practice Guidelines for Glomerulonephritis suggested tacrolimus as an elective routine for the underlying treatment for Idiopathic membranous nephropathy IMN, be that as it may, enormous observational investigations assessing tacrolimus treatment in IMN stays uncommon.

A S. De Vriese, Richard J. Glassock, Karl A. Nath, Sanjeev Sethi, and Fernando C. Ferverza[8] talked about that essential membranous nephropathy is brought about by antibodies against the as of late found podocyte antigens. The M-type phospholipase A2 receptor 1 (PLA2R) and thrombospondin type 1 space containing 7A (THSD7A). Assays for quantitative appraisal of against PLA2R antibodies are monetarily accessible, however a semi quantitative test to recognize hostile to THSD7A antibodies has been as of late created.

III. EXISTING METHOD

In the existing methods MN focuses on histological, pathological and clinical conditions of the patients. Kidney function was assessed through the blood test which measure waste products called urea and creatinine. Serum creatinine level determines the effectiveness of renal function. By using the variable(sc) an estimated glomerular filtration was calculated. Categorical variables are assumed as frequency and percentages. Constant factors rely on the mean and standard deviation values. The performance of the variables are performed by using the student's t test. Survival examination is carried out by using the Cox proportional value t. Survival Performance is performed using the Kaplan Meier method and significant value p is calculated and it was considered significant when it is less than 5. In the existing method the main clinical outcome is based on proteinuria and grafts dysfunction. Antibodies like phospholipase A2 receptors PLA2R and thrombospondin type I domain-containing 7A(THSD7A) are not identified. A large number of patients have not confirmed diagnosis of chronic kidney diseases which is very primary to the disease MN.

IV. PROPOSED METHOD

PLA2R antibody monitoring process is utilized to help in diagnosis and prediction of the disease Membranous Nephropathy (MN). The prediction of the disease was done on the basis of the significant value. The proposed work is carried out in step by step process so that the prediction of disease can be done easily.

1. Hypothesis is established in monitoring the PLA2R antibodies
2. Log rank statistics is used to calculate the t value, t value is taken as 0.05 which is referred to as percentage in the outcome of post transplant Membranous nephropathy.
3. But in the proposed method it is taken as decimal.
4. Statistical Hypothesis(s) is proven with logrank and chi square method.
5. Survival analysis is carried out with Kaplan Meier Method (t).

A. Performance of the proposed system

The dataset contains data of 400 samples from the southern part of India with their ages ranging between 2-90 years. There are in total twenty-four features, most of which are clinical in nature and the rest are physiological. The various attributes are tabulated in Table I.

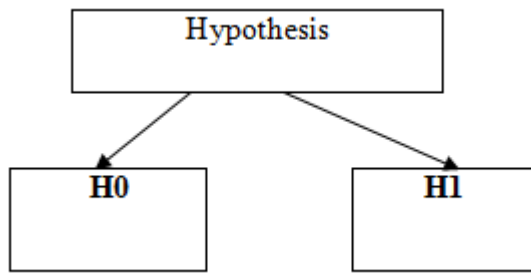
Table I: Characteristics of Membranous Nephropathy

1	Specific Gravity	13	Pus cell Clumps
2	Albumin	14	Age
3	Sugar	15	Blood
4	Red Blood Cells	16	Blood glucose random
5	Pus cell	17	Blood urea
6	Bacteria	18	Serum creatinine
7	Hyper Tension	19	Sodium
8	Diabetes Mellitus	20	Potassium
9	Coronary Artery Disease	21	Hemoglobin
10	Appetite	22	Packed cell volume
11	Pedal Edema	23	wbc
12	Anemia	24	Rbc

The table I specifies the various characteristics features of membranous nephropathy. Attributes are very important in prediction of the disease.

V. EXPERIMENTAL RESULTS

A hypothesis is used in the experiment to define the relationship between the variables. The hypothesis is assumed that H0 and H1. From this Hypothesis method it helps us to calculate statistical value(t) and it makes the significant value efficient.



Fig(a): Calculating the statistical value from the Hypothesis method

H0:

Monitoring PLA2R antibodies along with drug therapy doesn't have impact in diagnosis and treatment of Membranous Nephropathy

H1:

Monitoring PLA2R antibodies along with drug therapy have impact in diagnosis and treatment of Membranous Nephropathy

From the Hypothesis H0 and H1 Event can be generated as E1 and E2

Step1:The event is CDT (Combined Drug Therapy) and PLA2R monitoring (CBT+PLA2R) and Combined Drug Therapy (CDT) alone.

Step 2: Maximum time is taken as 24 months in this problem. The survival analysis is carried out for the patients who have diagnosed with the Membranous Nephropathy. Analyzing the PLA2R antibodies in the patient for over a period of time, prediction can be done. 10% of the samples are selected for the screening and empirical evaluation is carried out.

Consider the events E1 and E2

In start of the day 1,one patient among the 40 and the risk is as follows

$$(1/40)=0.025$$

In group 2 which considered as the second case in our experiment (CBT+PLA2RAntibodies), 20 patient ,lives could be saved at the star of the day. Hence the event is calculated as

$$T=20*0.025=0.5.$$

A total of 20 samples were taken and the scenario considered as follows

Case 1:Drugtherapy alone is provided(DT).

Case2:Combined drug therapy along with PLA2R antibodies(CBT+PLA2R Antibodies).

Table II: Screening of PLA2R Antibodies

Treatment	No of Patients(N)	Events(E)	Censored	
			N	Percent
DT	10	8	2	20.0%
CDT+PLA2R	10	8	2	20.0%
Overall	20	16	4	20.0%

The Table II helps us to identify the PLA2R antibodies and then to calculate the censored percentage.

Expected events calculated at different time are total number of expected events. In other group, total number of expected events can be obtained by subtracting total number of expected events from the total of observed events in both groups.

Time is calculated in terms of months. Status is whether the patient is available for the period over time. Totally we have two groups in which one group is receiving DT as in case1 and other group is having the scenario of the case2. The survival probability is calculated as specific time using the formula

$$S = \frac{\text{No. of subjects living at the start} - \text{No. of subjects died}}{\text{Number of subjects living at the start}}$$

Table III :Calculating the mean and median table of survival probability

Treatment	Estimate	Std Error	Confidence interval for Mean		Estimate	Std Error	Confidence interval for Median	
			Lower Bound	Upper Bound			Lower Bound	Upper Bound
DT	18.7000	2.019	14.742	22.658	23.000	5.627	11.970	34.030
CDT+PLA2R	17.200	2.121	13.043	21.357	18.000	6.197	5.854	30.146
Overall	17.820	1.421	15.035	20.605	18.000	4.140	9.885	26.115

The Table III calculates the mean and median mode for the survival probability with the Drug therapy and combined drug therapy with PLA2R antibodies.

Now we have the total number of expected events E (E₁, E₂). The observed events is termed as O (O₁,O₂). Then, the log-rank statistics would be calculated as

$$\text{Significant value}(t) = \frac{(O_1 - E_1)^2}{E_1} + \frac{(O_2 - E_2)^2}{E_2}$$

The statistic and significance value can be obtained by a comparative study of calculated values and critical values. The survival calculation is done by using the Kaplan Meier method. Survival time plays an important role in creating evidences based information on survival time.



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From the results the test statistic value (t) is less than the (p) value (0.05). Therefore there is a significant difference between survival.

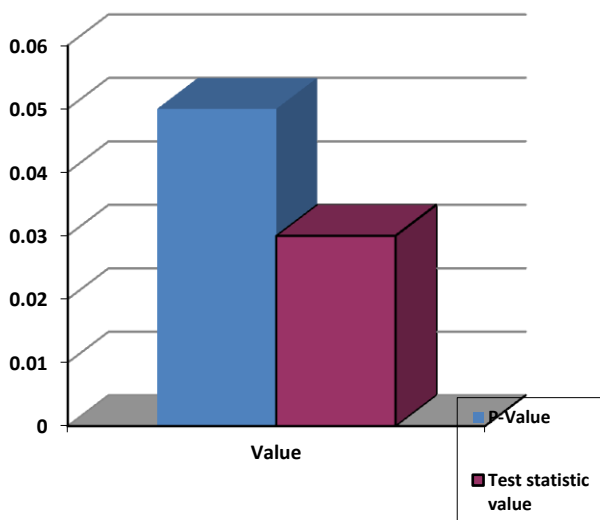
Table IV: Tabulation of Static and Significant Values

S.no	T-value	P-value
1	0.03	0.05

The Table IV helps us to identify the exact values of p and t.

Null Hypothesis value can be reduced with 95% from the test results. The base strategy[2] implies using combinatorial drug therapy alone and the proposed strategy utilizes monitoring.

VI. PERFORMANCE CHART



Fig(b): Performance Graph showing the value of p and t

The above figure clearly shows that the persons who adopt the method of combined drug therapy and PLA2R antibodies screening have the higher survival rate when compared with that of persons with the drug therapy alone.

VII. CONCLUSION

Membranous nephropathy is a serious implication which may create a life threat when not treated properly. In our proposed work the Kaplan-Meier survival analysis method is illustrated with selected sample of the dataset. And empirical analysis is carried out for the patients who continue with the drug therapy and combined drug therapy with PLA2R anti-body monitoring over a period of time. Based on that, the survival (cure, no cure) for the membranous nephropathy is determined. The Statistics value is calculated and is less than 5. Thus the proposed work helps in monitoring the PLA2R antibodies and helps us in appropriate tuning of the dosage and selection of drug in different times which had a significant improvement in diagnosis and treatment. Thus this paper makes a significant impact with the proposed method in assisting the clinical trials for the treatment of the membranous nephropathy. Our future work concentrates on to develop an efficient classification algorithm to get a clear prediction of the disease.

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