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An Clinical Study on Finding Hypothermia and Postpartum Haemorrhage Using Temperature

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Abstract--- *Hypothermia is the reduction of body temperature which is in the range of below 37^0 c. Severe and life threatening hypothermia will be happened when the body temperature goes below 30^0 c which will affect the pregnant women after deliveries. The novelty is to find a hypothermia affected patients using wearable devices. After delivery, this device wills measures the body temperature of pregnant women.The measured values is compared to the normal temperature value. If the value lesser than the normal level, then the values should be intimated to the doctor or nurse through IoT. Using Fuzzy techniques the predicted values from pregnant women will be used to predict the hypothermia affected patients*

Keywords--- *Hypothermia Identification, Temperature, Uterine Atony.*

I. INTRODUCTION

In United States the death rate increased to 1500 due to Hypothermia. It is more common in females during maternity. If the patient gets hypothermia, then they are in critical conditions. When your body loses heat faster than it produces it at that time hypothermia occurs. Cold-weather conditions or cold water are the major cause of hypothermia. But prolonged exposure to any environment colder than your body can lead to hypothermia if you aren't dressed appropriately or can't control the conditions. Patients with initial body core temperature ($<23^0$C) do not survive and the overall mortality rate of patients with hypothermia is approximately 40%.

Hypothermia increases death rate which is a frequent problem after delivery. The most hypothermic patients are either intoxicated or suffer from excess bleeding. It will reduce the respiratory rate and heart rate and also loss of consciousness. Based on the temperature level, hypothermia will classified in to three stages. when the patients are affected by Mild Hypothermia (320 to 350C), the symptoms of them are weakness, irritability, shivering, impaired co-ordination., when the patients are affected by Moderate Hypothermia (280 to 320 C),the symptoms of them are Shivering stops, delirium, dilated pupils, reflexes slowed.

The patients affected by Hypothermia < 280C or (82.4F) which causes them to suffer and die. Using fuzzy techniques, the parameter (temperature) will be analyzed. A fuzzy set is a pair where is a set and a membership function. The reference set (sometimes denoted by or) is called universe of discourse, and for each the value is called the grade of membership of in. The function is called the membership function of the fuzzy set. The fuzzy logic represents degree of truth instead of Boolean logic.

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II. RELATED WORK

Risk factors for severe postpartum haemorrhage: a case-control study by ill Trine Nyfløt, Irene Sandven, Babill Stray-Pedersen2 et al. [1] describes the concept of 4T's such as Tone (uterine atony, uterine inversion and abruption of the placenta), Tissue (retained placenta and retained parts of placenta, and abnormal placentation), Trauma (uterine rupture, birth canal trauma, and surgical trauma), and Thrombin (coagulation disorders).They mentioned all the invasive factors for extreme PPH that serves as a safety measure to avoid severe PPH conditions. The survey of different patients gives all the risk factors along with the occurrence of PPH which is clearly explained in the article. The prediction models for PPH under the development and validation must include the risk factor for the people with the history of severe PPH such as the greatest risk factor as well as other clinical level risk factors for PPH. Sue Pavord, Helena Maybury [2] in the paper How I treat postpartum haemorrhage 2015 Uterine blood flow, major obstetric haemorrhage [3], Uterine atony is explained. They applied the treatment of Coagulopathy, Fibrinogen Replacement, Tranexamic acid, Recombinant factor VIIa [4.5] and at last the surgical techniques [6]. The data is provided by a detailed experiment of patient and the risk factors and even all the clotting insufficiencies are clearly mentioned. Skilled multidisciplinary[7,8] care is required before, during and after childbirth to prevent PPH as far as possible but when it occurs, timely recognition, management and treatment can make the difference between life and death for mother and baby. Postpartum Haemorrhage[9] in 2012 by Cindy W. Su, MD profound "Four Ts" mnemonic (Tone, Tissue, Trauma, and Thrombin) are the major issues addressed and also the Usage of first line therapies and if incurable then adopted to second line therapies and in worst case all advanced surgeries are performed according to the complication. All the extra special cases and rare cases that lead to PPH are considered and the treatment is also mentioned. Creation of a standardized PPH protocol that involves simulation-based training with a multidisciplinary team may help decrease maternal morbidity and improve perinatal outcomes. Michelle A. Kominiarek, MD, Sarah J. Kilpatrick, MD, PhD [10] in Postpartum Haemorrhage: A Recurring Pregnancy Complication Profound Macrosomia Polyhydramnios Multiple Gestations Prolonged or augmented labours Prolonged third stage Chorioamnionitis Antepartum haemorrhage [8]. Active management of third stage of labour to prevent PPH. Next step is through uterotonics drugs followed by surgeries. A different and an noticed risk factor that is VON WILLIBRAND disease is mentioned and the key to management of PPH is early recognition and treatment. The goals are to ultimately reduce maternal morbidity and mortality is defined. The study conducted in the year 2010 reveals the entire details of postpartum haemorrhage in the paper. Episiotomy for vaginal birth [11] by Guillermo Carroli, Luciano Mignini in the year 2008 address an issue on Vaginal tears, cervical damage under macrosomy conditions. This paper gives successful deliveries with very less inconvenience and damage of the genital parts of women. It is very much useful in easy movement of baby in the vaginal canal without tears in the vagina, cervix. RANCOGZ in the year 2011 profound a paper based on Management of Postpartum Haemorrhage (PPH) [12] provides Uterine over-distension Multiple pregnancy, Placenta Praevia Placenta Accreta based issues. Also provides three methods (i.e) Mechanical: uterine massage, Pharmacological: uterotonics in varying combinations. Surgical: Balloon tamponade, B- lynch sutures, hysterectomy. All possibilities and risk factors are explained and the respective solutions to given are mentioned both through medicines and surgeries. Both medical therapy and surgical method for effective treatment of PPH is discussed. Prevention and Management of Postpartum

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Haemorrhage [13] in the year 2007 by Janice M. Anderson, M.D provides the case study and the Concept of 4T (Tissue, Thrombin, Tone, Trauma), uterine atony, resuscitation, Uterine massage, Uterotonics Agent. Primary factors for treatment of PPH are illustrated and a solution is provided for primary and secondary cases are well defined. Both the vaginal and surgical method is explained. R Christina Rini,V.D Ambeth kumar[14] has taken a survey about several immediate treatment for pateints who are all affected by postpartum haemorrhage.

III. DESIGN OF PROPOSED SYSTEM

The below Fig.1 depicts the identification of hypothermia For that purpose, temperature level of pregnant women will be collected at that time of delivery using wearable devices. If the level of temperature lesser than the 370 c, then they should be affected by hypothermia after delivery which causes them to die. So that the parameters should intimate to the doctor about the critical level of patients thereby protecting the pregnant women from maternal death. If the temperature level is normal, provide a medical guidance to them.

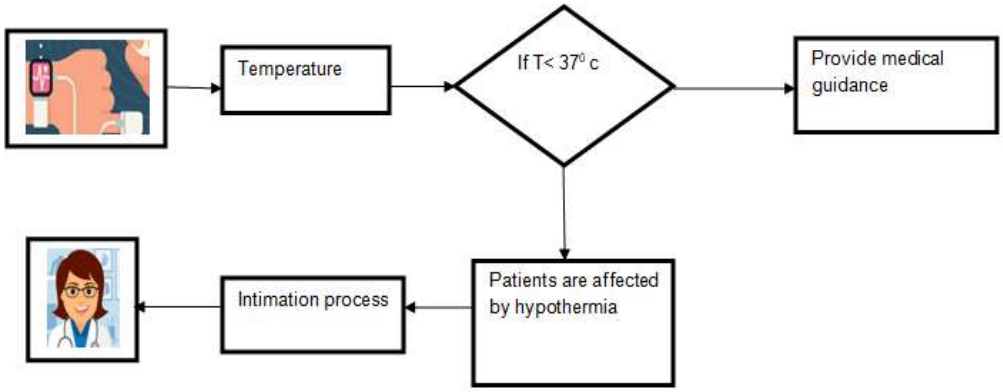

Fig.1 Identification of Hypothermia

3.1 Membership function for temperature

T be a fuzzy event whose membership function is $\mu_T(x)$. For $\mu_T(x) \subseteq [0, 1]$, so $\mu_T(x) = 1$, therefore a function exists $\mu_T(x)$ which satisfies the below equatio

$$\boldsymbol{\mu_T(x) = \int_b^c f\mu_T(x)\, dx = 1}$$

To identify the PPH patients, we should define the membership function $\mu_T(x)$ and it should satisfy the below equation

$$\boldsymbol{\mu_T(x) = \int_a^b \frac{x-a}{b-a} + \int_c^d \frac{d-x}{d-c}}$$

$$\boldsymbol{\mu_T(x)}$$

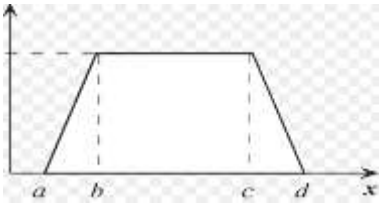

Fig.2: Membership function for temperature

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To define the membership function of pregnant women by using equation (1) which is shown below

$$\mu_T(x) = \begin{cases} 0 & , \ x < a \\ \sum_a^b \frac{x-a}{b-a} + \sum_c^d \frac{d-x}{d-c} & , a \le x \le b \text{ and } c \le x \le d \\ 1 & , b \le x \le c \\ 0 & , x \ge d \end{cases} \longrightarrow (1)$$

Where P = {P1, P2… Pn} indicates the number of pregnant women.

x= {x1, x2… xn} be the temperatures of N number of patients

"a" indicates the minimum body temperature of pregnant ladies which is less than 95(i.e.) Hypothermia defines abnormal low body temperature of them.

"b" denotes the starting temperature level of normal human body which is in 97.7 F and it indicates the patient's health condition is normal.

"c" denotes the ending temperature level of normal human body which is in 99 F and it is also indicates that patient's health condition is normal.

"d "denotes the maximum body temperature of the pregnant women which is more than 100.4 F and it indicates that pregnant women are affected by postpartum haemorrhage.

Pregnant ladies body temperature is in the range of 95 F-97.7 F and it represent the abnormal level,so we need to identify whether they can be affected by postpartum haemorrhage or not.

The temperature level lies between 97.7 F-100.4 F and it represents the abnormal parameters of them.

From the temperature of P, we will initiate algorithm for identifying the hypothermia and postpartum haemorrhage affected patients.

3.2 Algorithm for finding hypothermia

The normal temperature of pregnant women is 36.5^0C-37.2^0 C. when the patients are affected by hypothermia, their temperature lies below 30^0C. The membership function will be used to predict whether the pregnant women are affected by hypothermia or not.

Algorithm for finding hypothermia

INPUT: P= {P1, P2….Pn} be the number of patients
T: Temperature Level of them
OUTPUT: Hypothermia and postpartum haemorrhage affected patients will be identified based on the temperature level

BEGIN
IF (T<30^0C)
Print ("patient should affected by hypothermia and provide a immediate treatment to them")
ELSE IF (T>100.4)

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Print ("patients should be affected by postpartum haemorrhage")

ELSE

Print ("patient's health condition is normal")

END

From the above range of temperature level, membership function $\mu_T(x)$ will be reckoned which is shown in below table 1.

Table 1: Membership function of temperature for different person

PERSON(P)	TEMPERATURE (x)	$\mu_T(x)$
P1	100.6	0
P2	96.8	0.66
P3	96.7	0.629
P4	97.1	0.77
P5	97.4	0.88
P6	98.0	1
P7	99	0.55
P8	100.2	0.22
P9	100.1	0.33
P10	98.2	1
P11	92	0
P12	98.6	1
P13	97.4	0.8
P14	94	0
P15	96.8	0.6

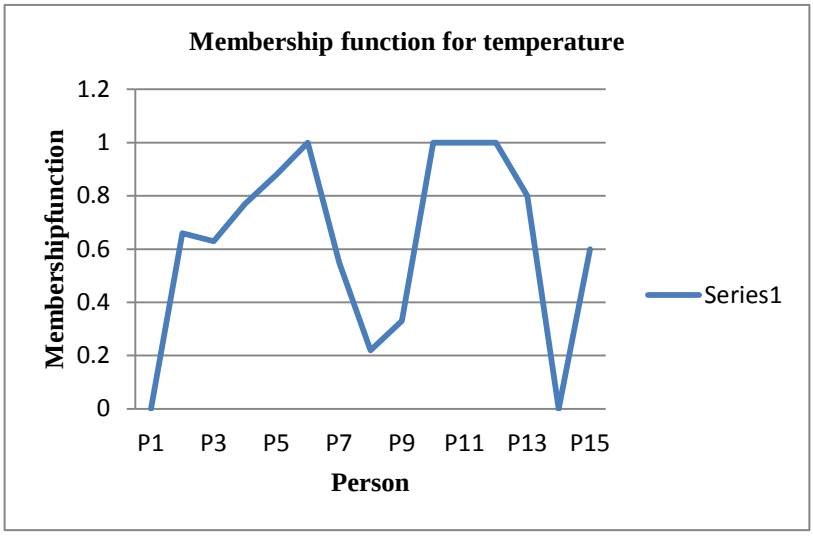

Fig.3: Affected patients list based on the above membership function

In Fig.3 person 6, person 10, person 12 won't be affected by postpartum hemorrhage because the membership function of them is equal to 1.person1 should be affected by postpartum hemorrhage, their temperature level exceeds than the average level. Person 11 and person 14 should be affected by hypothermia. Remaining persons are in an abnormal condition, so provide medical guidance to them.

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IV. CONCLUSION

Even though many medicines have come during the years but on an overall the global maternal mortality ratio is declined by only 2.3% year. This clearly signifies that the maternal death is still an issue with complications during deliveries and hypothermia is one of the main factors responsible for maternal death. Protocol in hypothermia and postpartum haemorrhage involves simulation-based training with a multidisciplinary team may help in reducing maternal morbidity and mortality. Therefore engineers should perform research on this bias to provide a suitable preventive solution to overcome this risk factors occurring due to hypothermia and PPH.

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