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Research Article

**WHICH IS BETTER AND WHY? A PROSPECTIVE RESEARCH  
ON INTENSIVE PHOTOTHERAPY AND EXCHANGE  
TRANSFUSION (ECT) FOR THE MANAGEMENT OF  
JAUNDICE IN NEONATES**<sup>1</sup>Dr. Ramshah Javaid, <sup>2</sup>Dr. Samna Naseer, <sup>3</sup>Dr. Aatar Yaqoob<sup>1</sup>WMO BHU Pathanwali<sup>2</sup>WMO BHU Thathi Minderwal<sup>3</sup>MBBS, University College of Medicine and Dentistry Lahore, Pakistan**Abstract:**

**Objectives:** Research objective was the assessment of the intensive phototherapy effectiveness for the exchange transfusion requirement reduction and phototherapy duration.

**Methods:** Our research design was prospective which included historical controls and it was carried out at Sir Gangaram Hospital, Lahore (January to August, 2017) including 360 children (newborns) diagnosed with an indirect hyperbilirubinemia. We made two groups of the total population respective Group "A" and "B" having 183 in "A" group which was also named as (Bili sphere group) were managed with Bilisphere-360 in comparison to the 177 newborns in Group "B" also named as (Controls) were managed through conventional phototherapy. Detailed clinical assessment was carried out in both "A" and "B" groups including laboratory investigations.

**Results:** We found in the research outcomes that exchange transfusion was reduced in 19 cases (10.4%) with the use of Bilisphere-360 in Group "A" against 130 cases of controls (73.4%) with a significant P-value as ( $< 0.001$ ); we found a reduction in the serum bilirubin level as exchange transfusion in subjects and controls was respectively (6.7 mg / dl, 24.9%) and (6.9 mg / dl 22.7%); the phototherapy duration was also shortened in both subjects and controls respectively as (2.7 days) and (4.2 days) with a significant P-value of ( $< 0.001$ ).

**Conclusion:** It is established fact as an outcome of the under-hand research that Bilisphere-360 is very effective to treat an indirect pathological hyperbilirubinemia because exchange transfusion lowers the total Serum Bilirubin when the level is in the range of (2 – 3 mg / dl, 34 – 51 $\mu$ mol / l) of exchange level. Phototherapy duration can be reduced with the management of Bilisphere-360 along with the exchange transfusion reduction because of the effectiveness of Bilisphere-360.

**Keywords:** Exchange transfusion, Intensive phototherapy, Bilisphere-360, Bilirubin, Newborns and Neonatal jaundice.

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## INTRODUCTION:

In the neonatal period neonates are commonly diagnosed with neonatal jaundice; which is estimated in newborns (60%) in the very 1<sup>st</sup> week after birth. It is very rare that Total Serum Bilirubin reaches to a level where it causes kernicterus, which is a condition that is characterized by neuronal and neurons necrosis bilirubin staining with the brain basal ganglia involvement and established in the hearing loss, athetoid cerebral palsy, upward gaze paralysis and dental dysplasia [1].

Repeated jaundice cause in the 1<sup>st</sup> twenty-four hours is new born HDN hemolytic disease is rhesus (Rh) hemolytic disease which is usually followed by ABO incompatibility resulting in the shape of increased anemia and bilirubin but it is also less severe than the Rh hemolytic disease [2, 3].

For the prevention of kernicterus and related hyperbilirubinemia complications, management of jaundice be made by exchange transfusion or phototherapy [4]. Phototherapy is among the useful technique as no complications are related to it and easily accessible. Its efficacy is dependent on the light wavelength and dose with exposed surface area [5]. Consideration of ECT is helpful to decrease the level of TSB for the prevention of kernicterus as it outweighs associated complications [6].

TSB can be rapidly decreased by intensive phototherapy under ECT threshold [7]. Research objective was the assessment of the intensive phototherapy effectiveness for the exchange transfusion requirement reduction and phototherapy duration.

## PATIENTS AND METHODS:

Our research design was prospective which included historical controls and it was carried out at Sir Gangaram Hospital, Lahore (January to August, 2017) including 360 children (newborns) diagnosed with an indirect hyperbilirubinemia. We made two groups of the total population respective Group "A" and "B" having 183 in "A" group which was also named as (Bili sphere group) were managed with Bilisphere-360 in comparison to the 177 newborns in Group "B" also named as (Controls) were managed through conventional phototherapy. Detailed clinical assessment was carried out in both "A" and "B" groups including laboratory investigations. We did not include all the premature newborns with gestational age (< 37 weeks), direct bilirubinemia cases, multiple congenital anomalies cases, critically-ill newborns and metabolism disorders cases.

We documented perinatal history which included maternal illness, delivery mode, Apgar score from 1 – 5 minutes, convulsion and cyanosis history, weight, gestational age, age at admission and gender. Vital signs were emphasized during clinical examination including anthropometric measures, cephalohematoma presence and neonatal reflexes neurological evaluation, consciousness level, motor and sensory functions.

In the chamber intensive phototherapy (Bilisphere-360) was excised on the subjects with sixteen blue (TL 20W) fifty-two cylindrically arranged fluorescent tubes. We laid the baby on gauze hammock which was suspended in the center of chamber and every side was illuminated. Conventional therapy was managed to historical control group. Every neonate in NICU was managed with hyperbilirubinemia in the AAP guidelines [8].

Every subject was measured at admission for direct and total serum bilirubin, reticulocyte count, complete blood count, Rh of neonate and mother, blood group and Direct Coombs test with the help of antiglobulin reagent specified for the IgG. A continuous phototherapy was given expect blood sampling, nursing care and feeding. While treatment only eye pads and diapers were available rest of the body was naked. We measured total bilirubin during phototherapy with intervals, risk factors and gestational age. Unresponsive hyperbilirubinemia cases experienced ECT with the help of fresh blood (O Rh negative), which was double of the baby's blood volume (2 x 85 ml / kg) [8]. Every outcome was recorded.

SPSS and M.S. Excel were used for the data entry and analysis. Student t-test was employed for the variables comparison; whereas for the non-parametric values we applied Mann-Whitney test. Two-sided P-values were observed with significant P-value as (< 0.05).

## RESULTS:

We found in the research outcomes that exchange transfusion was reduced in 19 cases (10.4%) with the use of Bilisphere-360 in Group "A" against 130 cases of controls (73.4%) with a significant P-value as (< 0.001); we found a reduction in the serum bilirubin level as exchange transfusion in subjects and controls was respectively (6.7 mg / dl, 24.9%) and (6.9 mg / dl 22.7%); the phototherapy duration was also shortened in both subjects and controls respectively as (2.7 days) and (4.2 days) with a significant P-value of (< 0.001). Positive jaundice family history and gender can be compared in both the groups. The most

common cause of the hyperbilirubinemia was incompatibility ABO in cases and controls respectively 89 cases (48.6%) and 90 controls (50.8%) with significant P-value as (0.49). No difference was observed in terms of gestational age, jaundice onset, birth weight and admission age.

Detailed outcomes regarding demographics, phototherapy duration, laboratory data and transfusion exchange are shown in Table – I. The decline in the bilirubin level is compared in Table – II and transfusion exchange in controls and cases have been compared in Table – III.

**Table – I:** Demographic, Laboratory Data, Phototherapy Duration and Transfusion exchange frequency in both groups

Patient's Data	Bili sphere Group (183)		Control Group (177)		P-Value
	Median	IQR	Median	IQR	
Gestational Age in Weeks	38	37 to 38	38	37 to 38	0.877
Birth Weight in Grams	2970	2602.5 to 3250	2900	2550 to 3222.5	0.8
Jaundice Onset in Days	2	1 to 3	2	1 to 3	0.697
Age on Admission in Days	4	3 to 6	4	3 to 6	0.606
Total Serum Bilirubin in mg/dl	26.2	24 to 30	27	25 to 31.05	0.08
Hemoglobin g/dl	12.9	11.62 to 14.90	13.4	11.67 to 14.90	0.713
Hematocrit	37.5	33.92 to 43.77	38	33.62 to 43	0.976
Platelets	264	213.25 to 327.50	258	203.75 to 325.50	0.421
White Blood Cells	10.7	8.80 - 14	11	8.25 to 13.6	0.808
Reticulocytes	7	3 to 13.9	7	2.4 to 13.27	0.755

**Table – II:** Bilirubin Decline Rate in Both Groups

Onset Time	Bili sphere	Controls
On Admission	27	28
After Six Hours	20	21
After 12 - 48 Hours	14	17

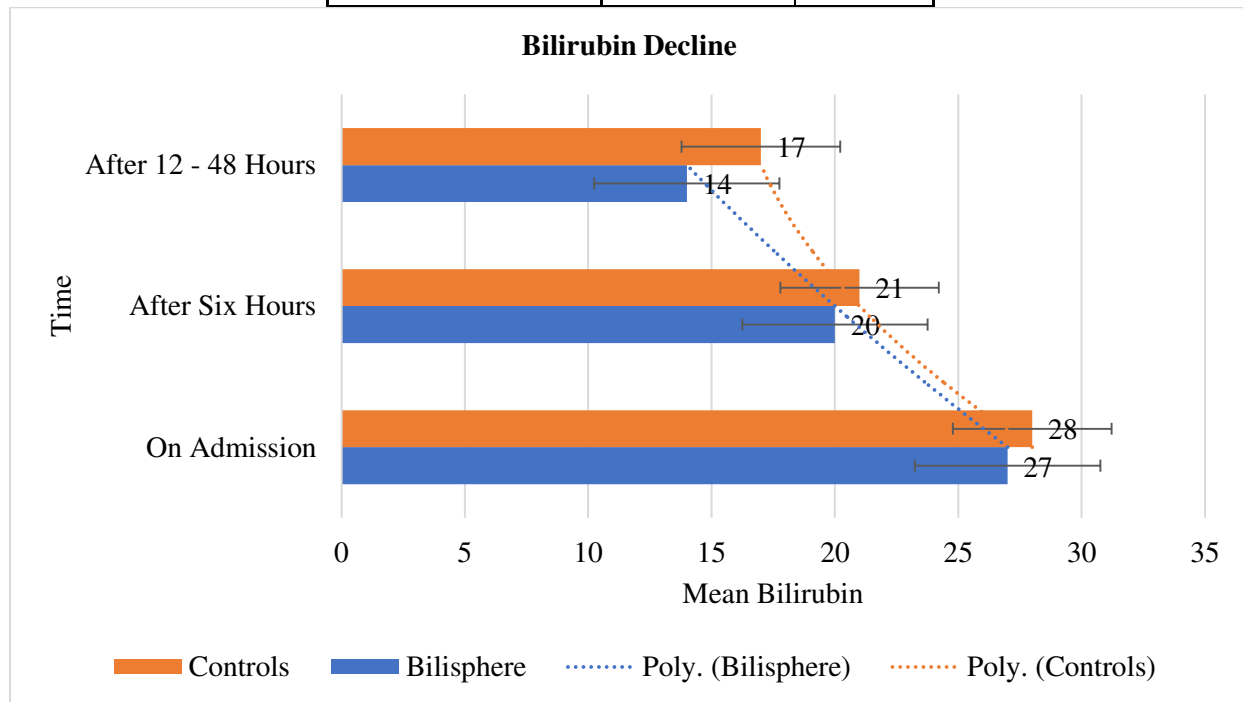
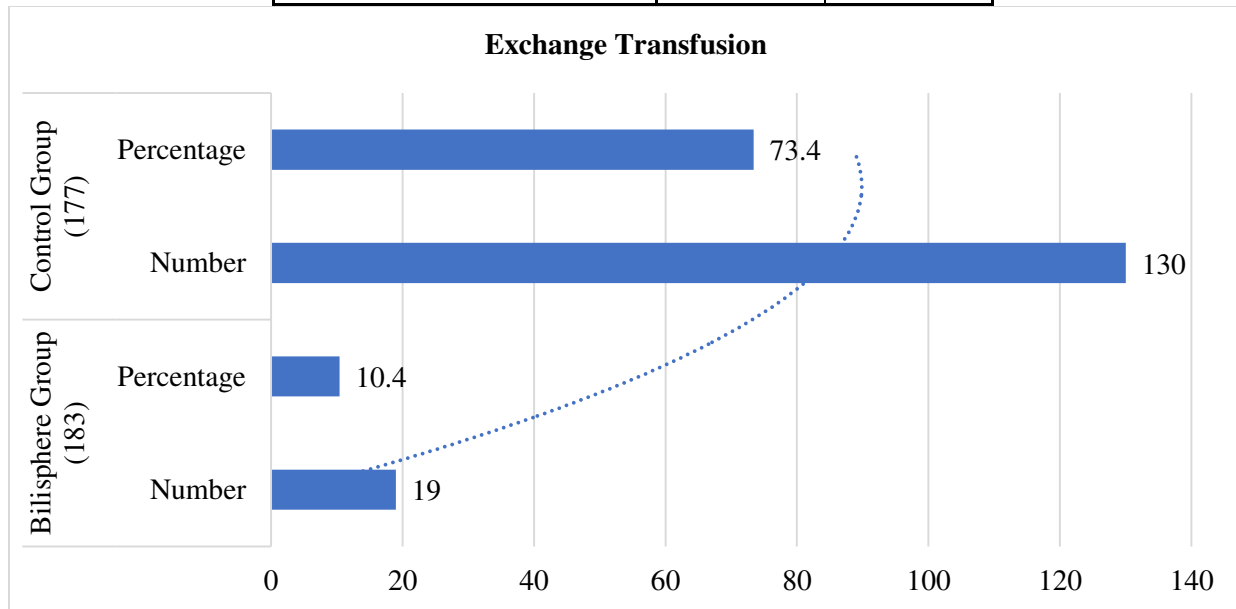


Table – III: Exchange Transfusion

<b>Bili sphere Group (183)</b>	Number	19
	Percentage	10.4
<b>Control Group (177)</b>	Number	130
	Percentage	73.4

**DISCUSSION:**

Jaundice is generally benign in the newborns as high TSB level can harm the central nervous system of the neonates. ECT and phototherapy are the main interventional options for the management of jaundice in the high-risk states [10]. Phototherapy is less expensive and safer than the ECT. ECT also needs expert handling and complex healthcare. Effectiveness of high-intensity phototherapy is accepted and decreased TSB rapidly than ECT. Bilisphere-360 is a modern device for the neonatal phototherapy [11]. We evaluated the effectiveness of the said interventions on two different neonates group and compared the outcomes.

It was established that Bilisphere-360 is better than the ECT for the rapid reduction of the levels of bilirubin in forty-eight hours after admission with a significant P-value as ( $< 0.05$ ). Our outcomes can be compared with the previously held research studies on the same topic regarding modern and conventional therapies [12]. During comparison of both the groups we also seen that there was no statistical variation in the first six hours of admission. However, obvious difference was found in the six to forty-eight hours regarding decline of the bilirubin. We may explain it

that higher percentage of the ECT treated cases in the first six hours of intervention.

The Bilisphere-360 effects have been studied by international and national institutes about intensive phototherapy on TSB blood levels over a time period of twenty hours in the neonates who were diagnosed with jaundice; it concluded that the TSB levels decrease was observed in 4<sup>th</sup>, 10<sup>th</sup> and 20<sup>th</sup> hour respectively 15%, 26% & 37% after exposure. In another research author reported after six hours' time as (23%) [13], which same as observed in the outcomes of our research observed at 6<sup>th</sup> hour as (24.9%). Hospital stays reduced with the Bilisphere-360 phototherapy management which reduces the overall treatment cost and burden on the hospital staff and more patients can also be accommodated. Child will be separated from mothers for a less period of time as duration of the hospital stay is decreased, resultantly breastfeeding will be less interrupted. Previously higher bilirubin decline rate and short duration intensive phototherapy action was also compared with the conventional interventions [15 – 17]. We observed significant shorter stay in the Bili sphere treated group and phototherapy duration in comparison with the control group (P-value  $< 0.001$ ). In the emergence of ECT for the Bili sphere group

neonates, 19 cases (10.4%) in the total of 188 neonates required ECT, which is more less than the control observed as 130 / 177 cases (73.4%). Previous reports were in line with our outcomes [14, 18].

### CONCLUSION:

It is established fact as an outcome of the under-hand research that Bilisphere-360 is very effective to treat an indirect pathological hyperbilirubinemia because exchange transfusion lowers the total Serum Bilirubin when the level is in the range of (2 – 3 mg / dl, 34 – 51umol / l) of exchange level. Phototherapy duration can be reduced with the management of Bilisphere-360 along with the exchange transfusion reduction because of the effectiveness of Bilisphere-360.

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