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Research Article

## Awareness of cord blood banking among pregnant women in semi urban area

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### ABSTRACT

**Background:** Hematopoietic stem cells (HSCs) are multipotent stem cells, derived from bone marrow, peripheral blood and umbilical cord. These HSC are accepted method of treatment for various disorders. Cord blood can be stored either in private or public bank. Awareness about cord blood banking among semi urban and rural population is less compared to urban population. The aim of our study is to evaluate the awareness of cord blood banking among pregnant women in semi urban area and to evaluate their willingness for donating to public blood bank.

**Methods:** This is a cross sectional study done among 365 pregnant women attending antenatal OPD in Obstetrics and Gynecology department of SMVMCH, Puducherry.

**Results:** Forty five percent of pregnant women had knowledge about uses of umbilical cord blood usage during pregnancy. Only 5 % of pregnant women knew about cost of stem cell storage. Less than 1% knew about availability of public cord blood banking. After informing about availability of public cord blood storage 72% of pregnant women were willing to donate to public bank.

**Conclusions:** Knowledge about cord blood banking is lacking among pregnant women. Especially majority of them are unaware of public cord blood banking. Private banking will be useful for those with family members affected with diseases amenable to HSC transplantation. More support from government and private organizations are required, which will help in better functioning of public cord blood bank services.

**Keywords:** Cord blood banking, Public banking, Private banking

### INTRODUCTION

Until recently umbilical cord and the placenta was discarded as medical waste after delivery. Hematopoietic stem cells (HSCs) are multi-potent stem cells, derived from bone marrow and peripheral blood. These HSC are also present in umbilical cord blood.<sup>1</sup> Umbilical Cord Blood (UCB) is a good source of hematopoietic stem cells (HSCs) that is equivalent to those found in the bone marrow. After delivery, umbilical cord blood can be collected and cryopreserved which can be used later. The stems cells in cord blood can grow into any type of cell especially blood and immune system cells, due to its

multi-potent nature. These HSC are accepted method of treatment for various blood cell disorders, cancers, genetic diseases, immune disorders and metabolic disorders.<sup>2</sup> Clinical trials are underway for neurological disorders, diabetes, auto-immune disorders and for some cardiovascular problems.<sup>3,4</sup> So far worldwide more than 30,000 cord blood transplantations were done successfully.<sup>5</sup>

As a result of the possible future need of cord blood for health problems and its advantages over other type of HSC transplantation, cord blood collection and storage has become popular worldwide. Apart from storage of

cord blood for personal use, cord blood is being stored in public bank like other blood and blood products. Awareness about cord blood banking among semi urban and rural population is less compared to urban population. The aim of our study is to evaluate the awareness of cord blood banking among pregnant women in semi urban area and to evaluate their willingness for donating to public blood bank.

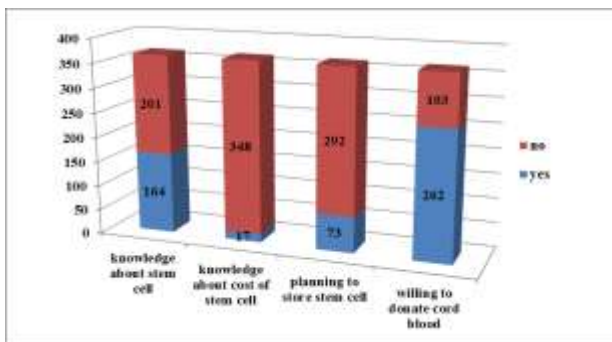
**METHODS**

This is a cross sectional study done in Obstetrics and Gynecology department of Sri Manakula Vinayagar Medical College Hospital, Puducherry, India from September 2015 to December 2015. This study was done among 365 pregnant women attending antenatal OPD during study period. This study was done in accordance with the ethical standards of the research committee. An informed written consent was obtained from each patient before this study was conducted.

Following information were collected in the antenatal women who were willing to participate and has given consent for the study. Proforma consisted of 2 sections. Section-I included socio-demographic status of the antenatal mothers such as age, educational status, address, occupation, religion and income. Section-II consists of data regarding pregnant women’s awareness, willingness for banking, source of information and the reason for hindrance in cord blood banking. Also their willingness for donating cord blood to public banking was assessed.

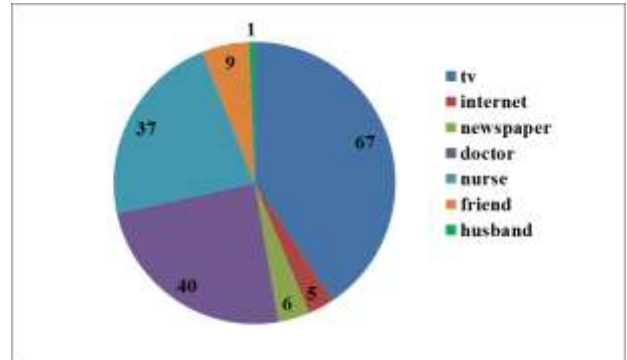
Socio-demographic factors such as age, educational status and income were assessed for their influence on knowledge of cord blood banking and willingness to donate to public banking. Previous obstetrics factors, consanguineous marriage, family history of cancer or genetic disorder were also analyzed for their influence on knowledge and willingness. Chi square test was used to analyze their influence on knowledge on cord blood banking and willingness for public banking.

**RESULTS**



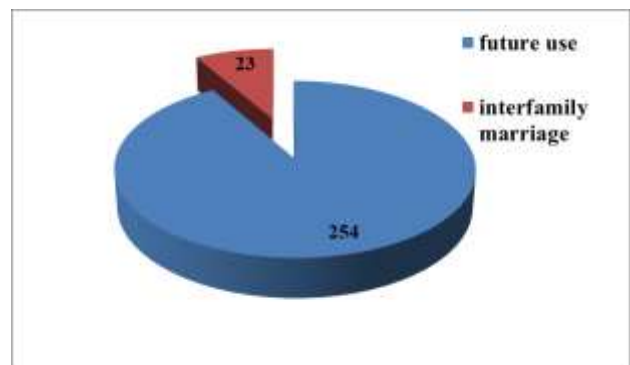
**Figure 1: knowledge and attitude of pregnant women towards cord blood banking.**

Forty five percent of pregnant women had knowledge about uses of umbilical cord blood storage. Only 5 % of pregnant women knew about cost of stem cell storage. Less than 1% knew about availability of public cord blood banking. After informing about availability of public cord blood storage, 72% of pregnant women were willing to donate to public bank (Figure 1).



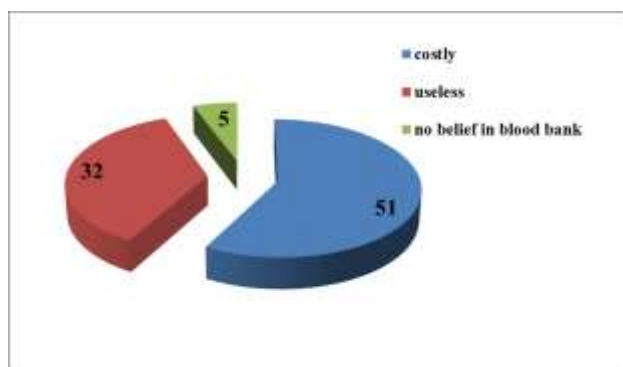
**Figure 2: Source of information.**

Television, doctors and nurses form main source to provide information to the public regarding umbilical cord blood storage (Figure 2). 47% of pregnant women had knowledge about umbilical cord blood storage prior to pregnancy. 14% of pregnant women came to know about umbilical cord blood usage during first trimester. 9% of them acquired knowledge about cord blood storage during 2<sup>nd</sup> trimester. Remaining 30% acquired knowledge during third trimester.



**Figure 3: Reason for positive attitude towards storing cord blood.**

Seventy six percent had positive attitude towards storing umbilical cord blood. Out of it, 92% had idea that it may be useful in future. Remaining 8% had positive attitude that it may be useful mainly for those who had interfamily marriage (Figure 3). Twenty four percent had negative attitude towards storage of umbilical cord blood. Out of it 58% thought that cord blood banking is costly. Thirty six percent had an idea that umbilical cord blood banking is of no use. Six percent did not have belief in blood bank (Figure 4).



**Figure 4: Reason for negative attitude towards storing cord blood.**

On analysing influence of various factors on knowledge towards cord blood banking, age and educational status had a statistically significant influence on it (p value <0.05) (Table 1). Family income, obstetric factors, consanguineous marriage and family history did not have influence on knowledge about cord blood banking. On analysing influence of various factors on attitude towards cord blood banking, only women who had previous  $\geq 2$  abortions statistically significant positive attitude towards it (p value <0.05). Other factors did not have influence on attitude towards cord blood banking. On analyzing influence of various factors on willingness towards cord blood donation to public bank, women who are graduates had statistically significant influence on it (p value < 0.05). Other factors did not have influence on willingness towards cord blood banking (Table 1).

**Table 1: Socio demographic factors influencing knowledge and willingness for cord blood banking.**

	n	Knowledge about cord blood banking	$\chi^2$	p value	Positive towards cord blood banking	$\chi^2$	p value	Willing to donate	$\chi^2$	p value
<b>Age</b>										
< 20 year	16	2			2			8		
20 - 30	311	143	7.33	0.026*	59	5.49	0.064	226	3.94	0.140
> 31	38	19			13			28		
<b>Education</b>										
Nil	17	4			3			11		
School	197	73	17.9	0.00*	33	3.27	0.195	131	7.54	0.023*
College	151	87			37			120		
<b>Monthly income</b>										
< 10000	167	68			29			118		
10000 - 40000	193	92	4.27	0.118	41	5.91	0.052	139	2.07	0.354
> 40000	5	4			3			5		

$\chi^2$  chi square; \*Statistically significant.

**Table 2: Obstetric and family factors influencing knowledge and willingness on cord blood banking.**

	n	Knowledge about cord blood banking	$\chi^2$	p value	positive towards cord blood banking	$\chi^2$	p value	willing to donate	$\chi^2$	p value
<b>No. of living children</b>										
0	159	60			31			107		
1	151	77	5.95	0.051	31	0.516	0.975	112	3.12	0.210
$\geq 2$	55	27			11			43		
<b>No. of abortions</b>										
0	288	125			60			205		
1	66	30			7			47		
2	9	8	7.33	0.062	4	8.32	0.040*	7	0.989	0.804
>2	2	1			1			2		
<b>No. of still birth</b>										
0	346	156			66			247		
1	18	8	0.821	0.663	7	4.45	0.108	13	0.405	0.817

	2	1	0		0		1			
<b>Consanguineous marriage</b>										
yes	71		30		17		46			
no	294		134	0.255	0.613		56	0.857	0.355	216
<b>Previous anomalous baby</b>										
yes	6		3		1		4			
no	359		161	0.633	0.801		72	0.424	0.837	258
<b>Family history of cancer/genetic disorder</b>										
Yes	9		4		2		4			
No	356		160	0.885	0.979		71	0.285	0.866	258

$\chi^2$  chi square; \*Statistically significant.

## DISCUSSION

There is a rising need for awareness among pregnant women about umbilical cord blood banking in our country. In the year 2020, estimated cases of leukemia will be 55,000 in India.<sup>6</sup> Till now, the reported number of patients with hemophilia A in our country is 11,586 but the estimated prevalence could be around 50,000 patients.<sup>7</sup> Hematopoietic stem cell transplantation (HSCT), resulted in cure in nearly 60% to 80% of these conditions. Many other diseases which could be treated by UCB transplantation is on rise.

Only 45% of pregnant women in our study had knowledge about usage of umbilical cord blood for therapy. Similar to our study results various other studies show pregnant women's poor knowledge on cord blood banking.<sup>8,9</sup> Only 5% of pregnant women knew about cost of stem cell storage. Less than 1% knew about availability of public cord blood banking. Whereas in western countries, people are well aware of uses of cord blood banking and also about public cord blood banking options.<sup>10,11</sup>

As corroborated from our study results, main reason for women having positive thought towards banking is, they thought it may be useful in future. Others thought it to be mainly useful for those who had interfamily marriage due to expected problem in the children. Reason for pregnant women's opinion against banking was mainly because of its cost. Other reasons being unwanted storage and lack of belief on blood bank.

On analyzing various factors influencing knowledge on cord blood banking, educated women are aware of use of cord blood as a treatment option. Those women who had previous pregnancy loss of  $\geq 2$  had a positive attitude towards banking of cord blood. Educating more women on this issue will help in motivating more women towards donation of cord blood for public banking.

Stem cells from bone marrow or peripheral blood have been used for HSCT in many clinical conditions. The use of umbilical cord blood (UCB) for HSCT provides some potential advantage over stem cells from bone marrow or

peripheral blood. Advantages include reduced incidence of graft-versus-host disease (GVHD), prompt availability, decreased risk of blood borne infections, and easy collection without affecting the mother or baby.<sup>12,13</sup> Stem cells from bone marrow or peripheral blood requires perfect HLA match between donor and patient.<sup>13,14</sup> But, UCB only needs to be matched at four of six HLA class I and II molecules. This is due to lower numbers of T cells and the relatively immunologically naive status of the lymphocytes in units of UCB, resulting in reduced graft-versus-host disease (GVHD).<sup>13,15</sup> In 70% of patients requiring stem cell transplantation, it is not possible to find a matching bone marrow donor within the family. In these situations, there is a need to rely on public bone marrow registry. Also people from minority group may not get exact HLA match for bone marrow transplantation if needed. As cord blood need not be matched as closely to the patient, use of cord blood for stem cells are particularly helpful to patients of minority group or mixed ethnicity.

Cord blood stem cell treatment can be either of autologous or allogenic transplantation. Autologous transplantation is usage of cord blood for self (stored at the time of birth). Allogenic transplantation is usage of cord blood from family member or unrelated donor stored in public banks. When parents store stem cells in private bank, they can use them for treatment of same child (autologous) or can be used for treatment of family members (allogenic).

Studies show that lifetime probabilities of undergoing HCT range from 0.23% to 0.98%.<sup>16</sup> Odds of a child using autologous cord blood in US is 1: 5,000.<sup>17</sup> A child using donor (allogenic) cord blood is 1:2,500.<sup>17</sup> Worldwide there are currently 207 private cord blood banks and 158 public cord blood bank.<sup>18</sup> Recent statistics show that cord blood banked in family banks is over 4 million in 2014.<sup>19</sup> Whereas cord blood units stored in public banks is over 630,000.<sup>20</sup>

Next question on cord blood stem cell banking is, does everyone need to store cord blood in family bank. Rao M et al in his study states that with increasing storage in private banking, public banks may not be able to provide

for the demand requiring cord blood transplantation.<sup>21</sup> There are two important reasons to favor against private banking. First reason is, any adult needing cord blood treatment, would need at least two cord blood units that are HLA compatible. Speedy engraftment and survival after UCBT depends on cord blood nucleated cell dose. A minimum total nucleated cell dose of  $2 \times 10^7$  /kg recipient body weight is essential. The median total nucleated cell yield of one cord blood unit is  $10 \times 10^8$ . Thus, a single, autologous unit is unlikely to be adequate for any individual over 50 kg.<sup>22</sup> Second reason is, for certain conditions child's own cord blood stem cell may not use for self-treatment in future. In case of cancers including leukemia and genetic diseases, the cord blood stem cells have tendency for the same disease.<sup>23</sup> However, stem cells from a donor can be used as long as there is a HLA match, even when the child may have his/her own cord blood stem cells stored.

Therefore routine storage of umbilical cord blood in private bank is not recommended by the American academy of paediatrics.<sup>24</sup> A common concern regarding cord blood banking is that marketing by private banks overstate the likelihood that families will use their cord blood.<sup>25-28</sup> A recent statistical analysis has shown that private banking is not cost-effective.<sup>29,30</sup> If everyone donates cord blood to public registries, there is an increased chance of someone benefiting from a double cord blood transplant.

Certain important things have to be taken into consideration while collecting cord blood. At least 40 mL of cord blood must be collected, to ensure adequate cells for transplantation. Blood should be collected immediately after birth to minimize coagulation and maximize cell count.<sup>31</sup> If the collected cord blood sample is not sterile or is not of sufficient amount, it will be discarded by the bank. There are problems associated with cord blood collection from preterm delivery. Early cord clamping appears to be disadvantageous to the preterm infant. Preterm babies are at risk of anemia and hypotension. Evidence from systematic review suggests that delaying cord blood clamping up to 2 minutes after delivery of baby, results in fewer transfusions for anemia and fewer intra-ventricular haemorrhages.<sup>32</sup>

Main problem for public cord blood banking is requirement of funds for functioning. Public cord blood banks are supported through government funds, private donations and compensation from the person utilizing cord blood units for HSCT. HLA typing of cord blood units at the time of collection helps them to be entered into cord blood registries. This helps in rapid location of specific HLA match identification for a patient in case of need. In India, the lack of accessibility of public banks is a major problem. There are only three public cord blood banks in India at present. More support from government and private organizations will help improvement in public cord blood bank services. This will result in increased usage and improved survival of person

suffering from diseases curable by cord blood transplantation.

## CONCLUSION

Knowledge about cord blood banking is lacking among pregnant women. Especially majority of them are unaware of the functioning of public cord blood banking option. Private banking will be particularly useful for those with family members affected with diseases amenable to cord blood transplantation. More support from government and private organizations are required, which will help in better functioning of public cord blood bank services.

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