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Impact of an educational intervention on maternity nurses knowledge regarding process of umbilical cord blood collection

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Abstract
Background: Collection and storage of an infant's cord blood at birth is an option available to many new parents. Antenatal health care providers have an important role in providing non-biased and evidence based information to expectant parents about cord blood and tissue banking options. Cord blood collection and stem cell research are the most important and controversial topics of science and technology today. Nurses need to understand stem cell research so they can enter the debate on this issue.
Aim: The aim of this study was to evaluate the impact of an educational intervention on maternity nurses' knowledge regarding cord blood collection and stem cells.
Methodology: This educational intervention study was conducted at SVS Hospital, Mahabubnagar, Telangana, India between January 2022 to June 2022. This study was conducted at two settings; labour unit in Obstetrics Department. All nurses working in the above mentioned settings at the time of the data collection were included in the study. Total number was 50 staff nurses were included in this study. Nurses were interviewed for 30-40 minutes and assessed before educational sessions. The duration of each session lasted from half an hour to one hour including periods of discussion according to their achievement, progress and feedback. Different methods of teaching were used such as modified lecture, group discussion and brainstorming. Immediately and after three months of implementation of the educational intervention, the follow up test for nurses' knowledge and attitude were done by the same format of the pretest to evaluate the effect of the implemented educational intervention.
Results: Out of 50 participants, it was found that nearly half of nurses (48%) were aged from 20-25 years, with a mean of age 24.86±6.82 years. As far as nurses' qualification, more than half of them (52%) had diploma. Regarding experience years at delivery room, about two thirds of nurses (62%), their experience ranged from 5-10 years, with a mean of 6.04±3.63 years. Only 6% of nurses were attended training courses about cord blood collection and stem cells. 86% of nurses had poor knowledge before intervention. However, 92% and 86% of them had good knowledge immediately and after three months of intervention respectively.
Conclusion: From this study, it can be concluded that there was a statistically significant improvement in nurses' knowledge mean scores, immediately, and three months after intervention, as well as there was a statistically significant difference in nurses' attitude scores before, immediately, and three months after intervention.

Keywords: Maternity, placenta, stem cells

Introduction
Umbilical cord is the vital direct interlink between mother and fetus, which is always depicted as the relationship of an emotional bonding of motherhood, which is a beautiful experience for a women [1]. When mother gives birth, the blood that remains in the placenta and umbilical cord is referred as cord blood. This particular blood contains numerous haematopoietic stem cells that have the ability to differentiate into other cells and the ability to self-degenerate [2]. Stem cells are found in all multi cellular organisms, and are characterized by the ability to renew through mitotic cell division and differentiate into a diverse range of specialized cell types.
Redefining health in its endeavour to bring a leading edge healing concept is proud to introduce stem cells therapy. Stem cells therapy is the most advanced technology available globally to repair the body's failing system. Umbilical cord blood is increasingly being used as a source of stem cells in the treatment of over 80 diseases, including leukemias, myelomas, lymphomas, genetic disorders/diseases, immune system deficiencies, and blood cell disorders [3, 4]. Stem cells from cord blood are much easier to get because these cells are readily obtained from the cord and the placenta at the time of delivery.

Similar to cord blood, connective tissue from a section of the umbilical cord can also be collected, preserved, and stored for use in clinical research, donated to a public cord blood bank, or kept in a private cord blood bank for future medical need. Even more than cord blood, Wharton's Jelly, the connective tissue surrounding the umbilical vein and arteries, is a significant source of specific stem cells called mesenchymal stem cells [5].

Umbilical cord blood collection is primarily carried out by obstetricians, midwives and nurses who have received training in this area. Cord blood is collected by a non-invasive and painless technique after cutting the umbilical cord from the newborn [6, 7]. The two methods of cord blood collection in practice are in-utero and ex-utero method, ex-utero method is more commonly used. The in-utero method involves the collection of cord blood after the newborn's delivery but before the delivery of placenta, whereas in the ex-utero method it is collected after the delivery of the placenta. Immediately after the newborn's delivery, the umbilical cord is clamped from the newborn and a needle attached to a collection bag pre-coated with anticoagulant is inserted in the umbilical vein [8].

The nursing role in collection of cord blood is preparation, tube labeling, and packaging. Cord blood is collected using sterile technique, drawing the blood from the umbilical vein into a collection bag, using a closed system collection kit, and total collected volume averages about 110 mL. In some cases, cord blood may be collected into tubes rather than a collection bag, also using sterile technique. In both cases, an anticoagulant is in the collection container. Cord blood collection is done within 10 minutes of birth [20]. Moreover, nurses and midwives are part of health care in all the stages of our lives. Thus, nurses must be knowledgeable and aware of recent trends in diagnosis, treatment. Continuing education provides means by which nurses can remain up to date with current developments, maintain their competence and meet the standards of nursing practice [10].

Nurses are thus challenged to assimilate knowledge, develop critical thinking skills and it is necessary to apply that knowledge into practice. Recent advances in science have demonstrated that umbilical cord blood is a rich source of stem cells, making it a valuable tissue resource in the clinical field of stem cell therapy and transplantation [11]. Sources of hematopoietic cells suitable for transplantation are the bone marrow and the peripheral blood under certain vibration conditions. The basic obstacle faced in transplantations is the rejection of a transplant from the human leukocyte antigen (HLA) molecules. The greatest chance of finding a matching donor is from within the family. Cord blood is a rich source of stem cells, while the collection does not pose any risk to the mother or child. The collection occurs after the birth of a healthy child and infections of the blood from viruses are relatively rare, even from viruses such as the magnocellular virus and Epstein-Barr. Each unit of Umbilical Cord Blood (UCB), frozen and stored in a cryogenic vessel, exists in real-time and is available upon request for patients with unstable disease [12, 13].

In spite of many benefits of the stem cells obtained from umbilical cord blood, the umbilical cord was considered medical waste and disposed of following delivery along with the placenta due to the lack of knowledge about its the benefits and uses. The aim of this study was to evaluate the effect of an educational intervention on maternity nurses' knowledge regarding cord blood collection and stem cells.

Materials and Methods

This educational intervention study was conducted at SVS Hospital, Mahabubnagar, Telangana, India between January 2022 to June 2022. This study was conducted at two settings; labour unit in Obstetrics Department. All nurses working in the above mentioned settings at the time of the data collection were included in the study. Total 50 staff nurses were included in this study.

Methodology

It encompassed two major parts: First part included personal and socio demographic data such as (age, qualifications, and years of experience in delivery room and attendance of training courses about cord blood collection and stem cells. Second part included nurses' knowledge about cord blood collection and stem cells. Nurses were interviewed for 30-40 minutes and assessed before educational sessions. The educational intervention involved (4) scheduled sessions and were implemented according to working circumstances, nurses' physical and mental readiness. These sessions were repeated to each subgroup of (3-5) nurses. The duration of each session lasted from half an hour to one hour including periods of discussion according to their achievement, progress and feedback. At the beginning of the first session an orientation to the educational intervention and its aims took place, Arabic language was used to suit the nurses' level of understanding. Feedback was given in the beginning of each session about the previous one. Different methods of teaching were used such as modified lecture, group discussion and brainstorming. Suitable teaching media were included an educational booklet that distributed to all nurses in the first day of the educational intervention as well as audio-visual aids and real objects such as cord blood collection set, a mannequin and real umbilical cord. Immediately and after three months of implementation of the educational intervention, the follow up test for nurses' knowledge and attitude were done by the same format of the pretest to evaluate the effect of the implemented educational intervention.

Results

Out of 50 participants, it was found that nearly half of nurses (48%) were aged from 20-25 years, with a mean of age 24.86±6.82 years. As far as nurses' qualification, more than half of them (52%) had diploma. Regarding experience years at delivery room, about two thirds of nurses (62%), their experience ranged from 5-10 years, with a mean of 6.04±3.63 years. Only 6% of nurses were attended training courses about cord blood collection and stem cells.

Table 1: Demographic details

Characteristics parameters	No	%
Age (years)		
<20	8	16
20-25	24	48
26-30	7	14
>30	11	22
Qualification		
Diploma	26	52
Diploma + specialty	11	22
Technical Nursing Institute	8	16
Bachelor of nursing	5	10
Years of experience in delivery room		
<5	14	28
5-10	31	62
>10	5	10
Attendance of training courses about cord blood collection and stem cells		
Yes	3	6
No	47	94

Table 2 displays that there was highly statistically significant difference before, immediately, and after three months of implementing educational intervention in relation to nurses'

knowledge regarding cord blood collection (definition, benefits, indications, contraindications, appropriate time of collecting cord blood, places for cord blood storage, length of time for cord blood storage, barriers of collecting of cord blood, and responsible persons for collecting cord blood).

Table 2: Assessment of knowledge regarding cord blood collection at different time intervals

Times of assessment	Before		Immediately after		After 3 months		P value
Items	**No**	**%**	**No**	**%**	**No**	**%**	
Definition of cord blood collection							
Correctly complete	6	12	42	84	33	66	
Correctly incomplete	13	26	8	`16	16	32	<.001
Don't know	31	62	0	00	1	2	
Benefits of cord blood collection							
Correctly complete	2	4	40	80	37	74	
Correctly incomplete	18	36	9	18	11	22	<.001
Don't know	30	60	1	2	2	4	
Indications of cord blood collection							
Correctly complete	1	2	40	80	37	74	
Correctly incomplete	13	26	8	16	10	20	<.001
Don't know	36	72	2	4	3	6	
Contraindications of cord blood collection							
Correctly complete	10	20	47	94	42	84	
Correctly incomplete	35	70	3	6	8	16	<.001
Don't know	5	10	0	0	0	0	
Appropriate time of collecting cord blood							
Correctly complete	14	28	49	98	48	96	
Correctly incomplete	13	26	1	2	2	4	<.001
Don't know	23	46	0	0	0	0	
Length of time for cord blood storage							
Correctly complete	0	00	42	84	30	60	
Correctly incomplete	3	6	6	12	16	32	<.001
Don't know	47	94	2	4	4	8	
Barriers of collecting of cord blood							
Correctly complete	0	0	41	82	35	70	
Correctly incomplete	7	14	09	18	11	22	<.001
Don't know	43	86	1	2	4	8	

Table 3 represents that there was highly statistically significant difference before, immediately, and after three months of implementing educational intervention in relation to nurses' knowledge pertaining technique of cord blood collection and stem cells (methods and preparations of umbilical cord blood collection, components of blood collection set, precautions of infection control, and procedure of aspiration, definition of stem cells, sites, importance, uses, and ethical considerations of obtaining stem cells from umbilical cord).

Table 3: Assessment of knowledge pertaining technique of cord blood collection and stem cells at different time intervals

Items	No	%	No	%	No	%	
Methods of umbilical cord blood collection							
Correctly complete	0	0	40	80	34	68	
Correctly incomplete	2	4	8	16	11	22	<.001
Don't know	48	96	2	4	5	10	
Preparations of umbilical cord blood collection							
Correctly complete	0	0	44	88	37	74	
Correctly incomplete	10	20	6	12	11	22	<.001
Don't know	40	80	0	0	2	4	
Components of blood collection set							
Correctly complete	0	0	39	78	32	64	
Correctly incomplete	4	8	11	22	15	30	<.001
Don't know	46	92	0	0	3	6	
Precautions of infection control							
Correctly complete	14	28	49	78	41	82	
Correctly incomplete	19	38	1	2	9	18	<.001
Don't know	17	34	0	0	0	0	
Technique of cord blood collection							
Correctly complete	0	0	37	74	30	60	
Correctly incomplete	2	4	10	20	16	32	<.001
Don't know	48	96	3	6	4	8	
Definition of stem cells							

Correctly complete	2	4	42	82	38	76	
Correctly incomplete	14	28	8	16	11	22	<.001
Don't know	36	72	0	0	1	2	
Sites of obtaining stem cells		0		76		66	
Correctly complete	0		38		33		
Correctly incomplete	17	34	11	22	15	30	<.001
Don't know	33	66	1	2	2	4	
Importance of obtaining stem cells from umbilical cord							
Correctly complete	0	0	37	74	29	58	
Correctly incomplete	3	6	9	18	16	32	<.001
Don't know	47	94	4	8	5	10	
Uses of stem cells							
Correctly complete	2	4	41	84	37	74	
Correctly incomplete	10	20	9	18	11	22	<.001
Don't know	38	76	0	0	2	4	
Ethical considerations of obtaining stem cells from umbilical cord							
Correctly complete	0	0	37	74	30	60	
Correctly incomplete	7	14	13	26	19	38	<.001
Don't know	43	86	0	0	1	2	

Discussion

This study provides nurses knowledge of the state of umbilical cord blood banking and the science of the use of umbilical cord stem cells, benefits, practice implications, advantages and disadvantages of different types of collection, storage and barriers of the application of umbilical cord blood banking, all are assessed by the nurses during implementation of this study through a structured self-administrative questionnaire. The results of this study indicate that nurses are poorly informed and had deficiency of knowledge and education regarding UCBB and that the vast majority are not being educated.

On assessing knowledge of the studied sample regarding cord blood collection and stem cells, the findings of the current study revealed that the studied nurses had poor knowledge about cord blood collection and stem cells before the educational intervention, their low scores of knowledge may be attributed to the fact that cord blood collection and stem cells are new advanced trend and the nursing schools curriculum, especially the secondary level schools are still deficient in this issue. As well as after graduation, nurses neglect reading updating their professional knowledge besides lack of motivation. Therefore, such the diploma nurses constituted the majority of the study sample; it was expected to find such low level of knowledge.

Meanwhile, immediately post-test and after three months of implementing the educational intervention, there was a statistically significant improvement for knowledge scores in relation to umbilical cord, cord blood collection, stem cell, and technique of cord blood collection and the majority of them had good knowledge. Such improvement might be accounted on nurses' interest to learn and acquire knowledge about the study topics as well as the written booklet distributed to nurses used as an ongoing reference, which was helpful in nurses' acquisition of knowledge. In addition, the application of adult learning rules throughout the educational sessions with encouragement of questions, participation, and interactions along the intervention as well as the use of multimedia.

Akshatha [14] reported a significant difference between the pre-test and post-test level of knowledge and concluded that structured teaching program was effective in improving the knowledge of staff nurses regarding placental stem cell banking. These findings are supported by Armson [15] who emphasized that perinatal care provider should be informed and taught about the promising clinical potential of hematopoietic stem cells in umbilical cord blood and about current indications for its collection, storage and use based on sound scientific evidence.

Fernandez *et al*, [16] who examine pregnant women's knowledge regarding cord blood banking as their support is crucial to the success of cord blood transplantation program. They found that, most respondents in their study rated their knowledge about cord blood banking as poor or very poor. Similar study which was done by Hatzistilli*et al*, [17] to examine the health professionals' knowledge and attitude towards the umbilical cord blood donation in Greec and concluded that, the knowledge regarding the donation of umbilical cord blood was evaluated to be 15.6% of the respondents regarding the collection's storage and use of UCB, furthermore, no statistical significant relationship has been found between the percentage of correct answers and years of experience. In contrast, the results of the current study seemed to be different from the results of the previous study which was done by Katz *et al*,[18] who study the attitude and knowledge of pregnant women in five European countries, they found that the source of knowledge mainly obtained from the internet. Moreover, in other study [19] that investigate the pregnant woman's level of knowledge about UCB, they found higher level of knowledge reported by the pregnant women and this is behind the fact that the quality of information among pregnant women was better than among donors and female blood donors was due to the information provided by professionals.

Concerning the nurses' knowledge about the type of storage banks, one third of the nurses reported that they knew the private banks as a type of storage while few of them reported public banks and half of the participant nurses didn't know anything about the type of storage. These results are disagreed with the results of a study of Scenic *et al*,[19], who study donating umbilical cord blood to a public bank or storing in a private bank, the knowledge and preferences of blood donors and pregnant women, they found that, few health professionals have the necessary information to understand the difference between the public and private banks and even fewer health professionals have adequate information education time to provide citizens with independent and accurate information necessary to ensure informed consent for umbilical cord blood storage.

Conclusion

From this study, it can be concluded that there was a statistically significant improvement in nurses' knowledge mean scores, immediately, and three months after intervention, as well as there was a statistically significant difference in nurses' attitude scores before, immediately, and three months after intervention. The implementation of an educational intervention was effective and

significantly improved nurses' knowledge and attitude towards cord blood collection and stem cells.

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