ORIGINAL ARTICLE Pediatric imaging

Assessment of parental knowledge and attitude about the ill effects of radiation in children in the gurugram region of Haryana

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ABSTRACT

Purpose: In pediatric imaging, knowledge of the benefits and risks is important for parents so that they understand the information and use it to make choices for their children. If they do not have adequate knowledge about that, they may make choices that are not beneficial and may be harmful to their children. The aim of our study was to assess the parental knowledge and attitude about the ill effects of radiation in our region.
Material and Methods: A quantitative cross-sectional study was conducted on 80 parents whose children presented to the radiology department for imaging procedures. A pre-designed questionnaire and individual interviews were used to ask parents about the information they possess about the use of radiation in medical imaging, its benefits, and risks.
Results: Most of the participants knew what radiation is and that it can be harmful to their children but did not know anything about the negative effects of radiation. 49 (61%) knew that children are at higher risk of harm from radiation than adults and only 28 (35%) were aware of the negative effects of radiation. Responses recorded an overall positive opinion of medical imaging.
Conclusions: Our findings show a poor level of knowledge and awareness among parents so it is difficult for them to make healthy choices for their children. The results of our study indicate that there are great benefits in communicating risks with parents. In addition, the level of comfort increases with the effective interaction between healthcare professionals and the parents.

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Introduction

Advanced imaging technology has become an essential means of clinical diagnosis and has improved patient care. As a result, the use of medical imaging has increased worldwide with an expanded spectrum of its applications in pediatric health care. It can provide accurate information to help diagnose and save millions of patients worldwide. However, inappropriate use may result in preventable radiation risks, especially in children [1]. Concerns about the potential future risks associated with exposure to ionizing radiation are increasing; especially in children because they are more radiosensitive than adults. Children are more likely to acquire radiation effects due to higher tissue sensitivity to exposure and longer expected life length, which increases the possibility of radiation effects [2]. Therefore, a balanced approach is needed that can recognize benefits and reduce risks in children. In pediatric imaging, knowledge of benefits and risks is important for parents so that they understand the information and use it to make choices for their children. If they do not have adequate knowledge about the benefits and risks of medical imaging, they may make choices that are not beneficial and may be harmful to their children. Thus, the extent of parental awareness of potential future risks associated with pediatric imaging remains relatively unknown [3].

In response to this need, the World Health Organization (WHO) periodically produces publications on pediatric imaging [1]. In a report issued by WHO in 2016, the importance of understanding the benefits and risks of pediatric imaging is discussed. It suggests that pediatric imaging needs to be optimized so that children are not exposed to unnecessary radiation. Healthcare providers who advise or perform procedures have a shared responsibility to communicate with the parents or caregivers of children. To inform parents or caregivers, their level of knowledge and extent of awareness should be determined [4].

Overview of Radiation

Radiation is the transmission of energy in the form of waves or particles. Radiation can produce ionization or biological changes in the medium through which it passes. Sources of exposure can be natural, such as soil, vegetation, environment, or outer space, radon from the ground, and human-made, which include industrial and medical origins. On average, people receive 80% of their annual exposure from background radiation. If medical imaging procedures are performed accurately in a proper setting, the benefits of the procedures can outweigh the potential risks. Increasing use of ionizing radiation raises justified concerns about the possibility of future risks, particularly when the exposure occurs in childhood. Childhood exposure is more concerning as developing organs are more radiosensitive than those of adults and are more likely to develop health effects [1, 5, 6].

Ill effects of radiation exposure in children

Medical imaging plays an important role in the diagnosis of many disorders in children. However, with an increase in radiation exposure, there is a probability of occurrence of ill effects in children. The health effects of radiation exposure are divided into two categories: deterministic effects and stochastic effects. Deterministic effects are health effects caused by cell death. It has a threshold radiation dose below which the effects do not occur. Examples include acute radiation syndrome, skin redness, hair loss, and cataracts. Compared to deterministic effects, there is no threshold value for stochastic effects. These effects have an increase in the probability of occurrence with an increase in dose. The result of stochastic effects can be observed later in life. These effects are initiated by the alteration of cells, especially DNA. Changes in DNA structure can lead to uncontrolled multiplication, and cancer is believed to result from DNA misrepair [6,7].

Children are much more sensitive to the damaging effects of radiation because they have a larger proportion of dividing cells. The cells in children divide rapidly, providing more opportunities for radiation to disrupt the process and cause cell damage and changes in DNA structure. In addition, the effects of radiation can take many years to manifest, and children have more years ahead of them to experience these harmful effects [1,7].

The major goal of the assessment of radiation risk knowledge in parents is to ensure that they are receiving sufficient information so that they can make decisions for their children. Children cannot make such decisions due to a lack of knowledge and awareness in their age group. Parents and caregivers accompany children to medical imaging and make decisions for them. So, they need to have sufficient and straightforward information to understand the benefits and risks that come with medical imaging [8-10]. The purpose of this study is to assess parental knowledge of radiation use in medical imaging, its benefits and risks, and to improve their understanding and attitude about medical imaging, through a cross-sectional study.

Material and methods

This quantitative cross-sectional study was conducted on the parents or caregivers who accompanied their children for medical imaging in the Radiology Department of SGT University, Hospital & Research Institute. Parents of children aged 2 to 12 years were included in this study to assess their knowledge and attitude about the ill effects of radiation on children. The total study population consisted of 80 parents who visited the Radiology Department for medical imaging during the study period. Data were collected using a pre-designed questionnaire and individual interviews. Parents who lacked sufficient knowledge were provided with a brief explanation of the use of radiation in medical imaging, its benefits, and its risks.

Unwilling parents and parents of children with serious trauma or illness were excluded from the study to avoid putting any patient at risk of delayed urgent care. Parents of children waiting to undergo medical imaging procedures were approached and asked to spare 20 to 25 minutes. Only one parent of each child was asked to participate in the study. They were provided with an information sheet where the objectives of the study were laid out in both English and Hindi languages. Participants who could read on their own were provided with an information sheet, and those who could not read were explained the objectives of the study. After ensuring that the parents understood the purpose of the study, they were asked to sign a consent form, which was also available in both languages. Parents were encouraged to answer the questions to the best of their abilities. Questions were asked verbally in the local language, and questionnaires were filled out by the author. Most of the questions were in a yes or no format. Once they completed the survey, an interactive discussion was conducted with parents/guardians about the use of radiation, its benefits and risks.

Results

During the study period, 80 parents or caregivers at the Radiology Department of SGT University, Hospital & Research Institute were enrolled in the study. A signed consent form was obtained from all ~~the~~ parents. Educated participants read the information sheet before signing the consent form and it was read to the illiterate participants by the author. All parents consented to participate in the study. A total of 32 questions were included in the analysis. Most of the participants answered all the questions in the survey.

Demographics

Out of a total of 80 participants, 48 (60%) of the participants were fathers and 32 (40%) were mothers. The mean age of the children was 5 years (Fig. 1). Most of the participants had some level of education, and all the fathers stated working as their occupation (Fig. 2). Also, most of them were from rural areas. Overall, among the total participants, 28 (35%) reported prior experience with having a child undergoing radiographic procedures and the remaining 52 (65%) presented with their first procedure (Table 1).

Knowledge of radiation and its ill effects

The second section of the survey included the lev-

Table 1: Sociodemographic information of the parents

SOCIO-DEMOGRAPHIC INFORMATION			
Child's age			
2-5 years	6-9 years	10-12 years	
36 (45%)	28 (35%)	16 (20%)	
Parent's age			
18–29 years	30–39 years	40–49 years	> 50 years
47 (58%)	20 (25%)	13 (16%)	0
Parent's education			
Illiterate	School Education	Graduate	Post Graduate
8 (10%)	49 (61%)	21 (26%)	3 (3%)
Parent's occupation			
Working	Homemaker		
50 (62%)	30 (38%)		
Place of residence			
Urban	Rural		
10 (12%)	70 (88%)		
Socio-economic status			
High	Middle	Low	
0	48 (60%)	32 (40%)	
Number of previous radiographic procedures of the child			
None	1 to 5	6 to 10	>11
52 (65%)	26 (33%)	2 (2%)	0
Present radiographic procedure of which part			
Head	Extremities	Body area	Small bones
5 (6%)	18 (22%)	38 (47%)	22 (25%)

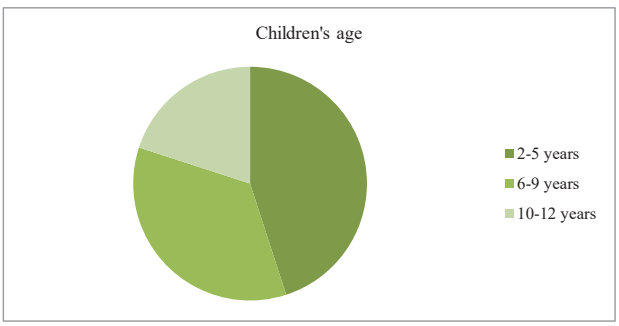

Figure 1: *Children's age*

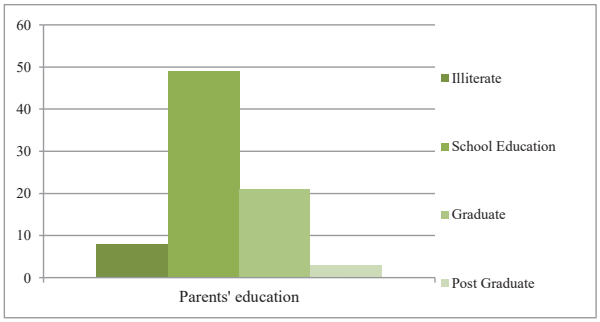

Figure 2: *Education status of parents*

Table 2: Knowledge of radiation and its effects **KNOWLEDGE OF RADIATION AND ITS ILL EFFECTS**				
Participants who knew what radiation is				
Yes	No			
60 (75%)	20 (25%)			
Participants who knew that radiation was harmful to their children				
Yes	No	No idea		
52 (65%)	2 (3%)	26 (32%)		
If participants were explained the purpose of the radiographic procedure by the referring doctor				
Yes	No			
58 (72%)	22 (28%)			
If participants were explained the negative effects of radiation related to the procedure				
Yes	No			
2 (3%)	78 (97%)			
If participants think that there is any number of radiographic procedures that a child can undergo in a year				
Yes	No	No idea		
45 (57%)	12 (15%)	23(28%)		
Which of the modalities uses radiation				
USG	CT	MRI	X-ray	All of the mentioned
0	7 (8%)	8 (10%)	14 (18%)	51 (64%)
If participants knew about the negative effects of radiation				
Yes	No			
28 (35%)	52 (65%)			
If participants knew that radiation exposure during pregnancy can have negative effects on the baby				
Yes	No			
75 (94%)	5 (6%)			
If participants knew that children are at a higher risk of harm from radiation than adults				
Yes	No			
49 (61%)	31 (39%)			
If participants knew that we get background radiation exposure from the environment				
Yes	No			
38 (47%)	42 (53%)			
Participants' opinion on days of background radiation exposure equal to the radiation dose a chest x-ray has				
4 days	8 days	10 days	12 days	No idea
12 (15%)	18 (22%)	10 (12%)	3 (4%)	37 (47%)

Participants' opinion on days of background radiation exposure equal to the radiation dose a CT chest has				
1 year	2 years	3 years	4 years	No idea
11 (14%)	14 (17%)	4 (5%)	8 (10%)	43 (54%)
Participants' opinions on which ill effects can be caused by radiation exposure				
Cancer	Cataract	Skin erythema	All of the mentioned	
19 (24%)	2 (2%)	3 (4%)	56 (70%)	

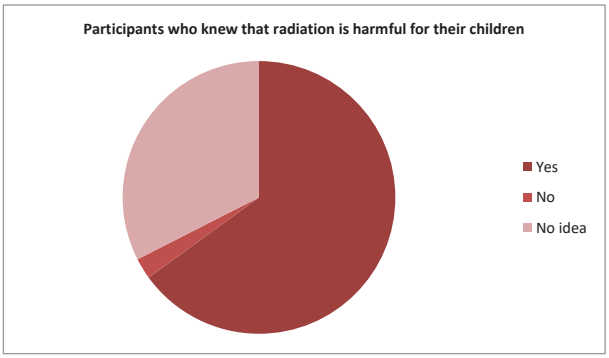

***Figure 3**: Level of knowledge of participants*

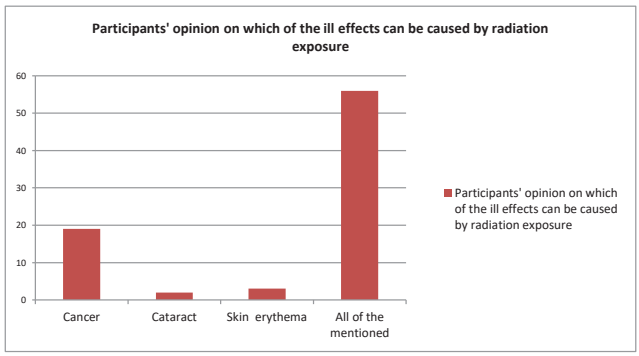

***Figure 4:** Participants' opinion on which of the following ill effects can be caused by radiation exposure.*

el of knowledge of radiation and its ill effects on the parents or caregivers. Most of the participants knew what radiation is and that it can be harmful to their children but did not know anything about the negative effects of radiation (Fig. 3). Most of the parents stated that they were explained the purpose of the radiographic procedure by the referring doctor, but they felt that the negative effects of radiation related to the procedure were not explained to them. The majority of the parents knew that radiation exposure during pregnancy can have negative effects on the baby. Only 40 (61%) of the parents knew that children are at higher risk of harm from radiation than adults. 38 (47%) of the participants were aware of the background radiation exposure from the environment and 42 (53%) did not have any idea about the exposure. When asked to compare one X-ray or CT scan's exposure to days or years of background radiation exposure, most of the parents found it difficult to compare. When asked about the negative effects of radiation exposure, 19 (24%) parents believed that the negative effect could be cancer, 2 (2%) selected cataracts, 3 (4%) selected skin erythema, and the remaining 56 (70%) stated that all the mentioned effects could occur (Fig. 4). There was no relation found between the level of knowledge of parents and their prior experience with radiographic procedures. In addition, it was observed that a higher level of parental knowledge was associated with a higher level of education. Very few parents stated doctors and technologists as their sources of knowledge (Table 2).

Attitude about the ill effects of radiation

Several elements of attitude were measured, namely the perception of how good, pleasant, useful, and safe medical imaging is for their children. Responses recorded an overall positive opinion of medical imaging with over 71 (89%) of respondents agreeing to medical imaging as 'useful' and 9 (11%) perceiving it as 'good' and 'safe' (Fig. 5). This indicates that parents think medical imaging is useful, but they do not know if it's safe for their children. 48 (60%) of the partici-

Table 3: Attitude about the ill effects of radiation ATTITUDE ABOUT ILL EFFECTS OF RADIATION			
Participants' description of medical imaging for their children			
Good	Pleasant	Useful	Safe
5 (6%)	0	71 (89%)	4 (5%)
If radiographic procedures are essential for the treatment plan			
Yes	No	No idea	
48 (60%)	18 (22%)	14 (18%)	
Information that participants seek from doctors in the future			
Purpose of procedure	Risks	Benefits	All
2 (2%)	19 (24%)	0	59 (74%)
Benefits of radiographic procedures are more than the risks for children			
Agree	Disagree	Neutral	
29 (36%)	40 (50%)	11 (14%)	
If the number of prescribed radiographic procedures is more than one, it would be better to take them in different sessions			
Agree	Disagree	Neutral	
51 (64%)	20 (25%)	9 (11%)	
Doctors who plan their treatment without radiographic procedures are better			
Agree	Disagree	Neutral	
27 (34%)	43 (54%)	10 (12%)	
Preferred method of communication in the future			
Oral	Written	None	
76 (95%)	4 (5%)	0	

pants believed that radiographic procedures are essential to the treatment plan, 18 (22%) believed that it is not essential and 14 (18%) had no idea about the same. 29 (36%) of the parents agreed that the benefits of radiographic procedures are more than the risks in children while 40 (50%) of them disagreed with the same. If the number of prescribed radiographic procedures is more than one, 51 (64%) of the parents agreed to take them in different sessions, 20 (25%) disagreed and 9 (11%) were neutral about this statement. 27 (34%) of the respondents believed that doctors who plan their treatment without radiographic procedures are better and 43 (54%) disagreed with it (Fig. 6). The majority of the parents prefer the oral method of communication for the future (Table 3).

Feedback from the participants

All of the participants found this session valuable

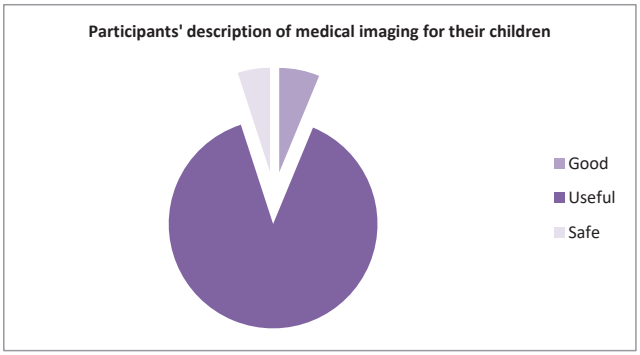

Figure 5: *Participants' description of medical imaging for their children*

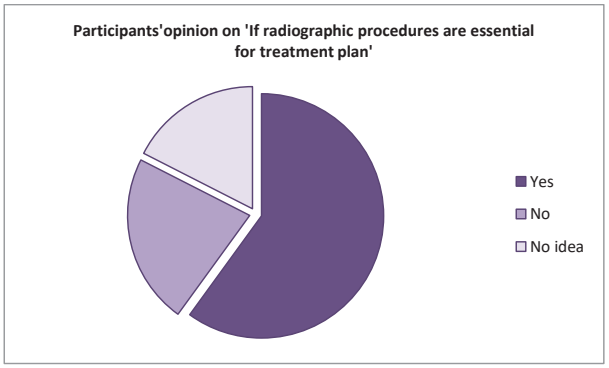

Figure 6: *Participants' opinion on 'if radiographic procedures are essential for treatment plan'.*

and agreed to pass on the information to family and friends. Also, they felt a strong need to seek information about the procedure, benefits, and risks from health care workers in the future.

During the discussion with parents, it was displayed that they blame healthcare professionals for not illustrating the benefits and risks of radiographic procedures. They presented the need for communication with hospital staff regarding the procedures. Also, they mentioned the lack of time and confidence to ask questions while meeting the referring doctors. All of them wished to obtain more information from the hospitals. This survey helped them to get sufficient information to utilize it in the future to make healthy choices for their children.

Discussion

The importance of patient information about the benefits and risks of radiographic procedures has been globally highlighted [8-10]. This study revealed that parents are not aware of the use of radiographic procedures for their children. Specifically, information about the radiation is poor. The study population of the present study comprised parents of children between the age of 2–12 years. This age group was chosen because parents or caregivers are more responsible for the treatment of the child up to the age of 12 years. This survey concentrated on radiographs more as they make up most of the examinations in children that can be repeatedly performed.

Out of 80 participants, most of them knew what radiation is and that it can be harmful to their children but did not know anything about the negative effects of radiation. There was some connection found between the educational status of participants and their level of knowledge of radiation. Overall, parental knowledge is not sufficient for making wise decisions for their children.

In regard to parental attitude about the radiographic procedures, it was observed that they think procedures are useful for their children but did not know anything about their benefits and risks. Also, a smaller number of parents agreed that the benefits of radiographic procedures are more than the risks in children.

It was observed that they blamed healthcare workers for the lack of communication and stated lack of lack of time and confidence to ask questions from the referring doctors. Parents did not have much understanding in this regard, so they preferred to do what doctors were advising.

According to the present study, parents wish to receive information even in connection with the risks and benefits of radiographic procedures. The majority of the participants preferred the oral method of communication for the future and would like to have the possibility to ask questions from healthcare workers.

On this account, we should respond to the wishes of parents and not be too concerned about causing anxiety and fear among them. In fact, a proper way of delivering information can even reduce anxiety. Due

to the general sense of fear of radiation, the method of communicating risks is important. However, the level of the information should depend on the nature of the procedure and on the receiver. Also, communication is a challenging task with low levels of educated people in rural areas and difficulty in understanding the radiation dose and risks and unsureness of the risks. In pediatric healthcare, a major goal of radiation risk communication is to ensure that parents or caregivers receive the sufficient information that they need to make decisions for their children. In general, the referring doctors have the complete clinical information and can discuss it with the parents while requesting ~~for~~ radiographic procedures. If needed, radio technologists could give additional information. Parents should always be provided with the opportunity to ask questions. The oral method of communication can be preferred overwritten as parents can ask questions or doubts at the same time if they have any.

Our findings show poor levels of knowledge and awareness among parents, so it is difficult for them to make healthy choices for their children. The results of the present study indicate that there are great benefits in communicating risks with parents. Also, the level of comfort increases with the effective interaction between healthcare professionals and the parents. Therefore, it is important to emphasize the role of healthcare professionals in initiating conversations with families and the effectiveness of communication regarding the risks and benefits of medical imaging for their children.

Strengths and Limitations

To our knowledge, this study provides the assessment of parental knowledge and attitude about the ill effects of radiation in children. This study helped us determine the level of knowledge of parents and the need for awareness and communication with parents. It also stated the beliefs and wishes that parents have regarding medical imaging in children. However, this study presents a limitation. The present study has a small sample size and all participants enrolled were from the radiology department of SGT University, Hospital & Research Institute. The continuation of this research topic with a larger sample size will lend a greater ability to conduct an analysis and consideration of secondary factors. **R**

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