

Original Research Article
IEC (Information Education Communication) module
as an effective tool for mitigation of iron deficiency
anaemia among rural adolescent girls of Tarai
region of Uttarakhand, India

ABSTRACT:

Aim: The present study was planned to assess the effectiveness of Information, Education, Communication module in reducing the incidence of anaemia among rural adolescent girls by bringing about a change in their knowledge attitude and practices related to this nutritional deficiency disease.

Study Design: Concurrent parallel study design

Place and duration of the study: Department of Foods and Nutrition, College of Home Science, G. B. Pant University of Agriculture and Technology, Pantnagar, between November, 2015 to October, 2016.

Methodology: A total of 288 rural adolescent girls of government schools in the age between 13-16 years were taken for the study. Subjects were divided in 2 groups: experimental group (exposed to IEC) and control group (not exposed to IEC), each having 144 girls each. Haemoglobin levels and knowledge, attitude and practices (KAP) scores were recorded using haemoglobin meter and questionnaire respectively, before and after IEC programme in both the groups. Paired-t test and z test were applied to compare changes before and after the intervention in haemoglobin level and knowledge, attitude and practices scores of the adolescent girls.

Results: Improvement in the knowledge, attitudes and practices of the subjects in experimental group was observed (increase of 18.93 percent in knowledge, 6.79 percent increase in attitude and 4.51 percent increase in practice score), though statistical significance could not be established. Favourable effect of IEC programme on haemoglobin levels of the experimental group was evident as the proportion of subjects having normal haemoglobin levels increased significantly from 0 to 27.08 percent, moderate anaemia was decreased from 30.55 percent to 11.11 percent post IEC programme, while in control group no significant changes were observed.

Key words: Information, Education, Communication, Haemoglobin, Adolescents, Anaemia

1. INTRODUCTION:

Adolescence is marked by a rapid phase of growth and development during which the requirement of nutrition and micronutrients is relatively high. Therefore, adolescents, especially girls, are vulnerable to iron deficiency. Anaemia affects half a billion women of reproductive age worldwide. Anaemia impairs the health and well-being in women and increases the risk of maternal and neonatal adverse outcomes (1). In 2011, 29% (496 million) of non-pregnant women and 38% (32.4 million) of pregnant women aged 15-49 years were anaemic (2). Studies indicate that the incidence of anaemia in adolescents tends to increase with age and corresponds with the highest acceleration of growth during adolescence. The highest prevalence is between the ages of 12-15 years when requirements are at peak. More than 50% girls in this age group have been reported to be anaemic (3,4,5,6). According to National Family Health survey-4 (2015-2016) (7) in Uttarakhand state of India 46.1 and 43.4 percent of rural and urban non-pregnant women respectively of age 15-49 years are anaemic (<12.0 g/dl).

Iron requirements increase dramatically during adolescence as a result of the expansion of the lean body mass, total blood volume and the onset of menstruation. These changes make adolescent girls more susceptible to anaemia, which has lasting negative impact for them and for the survival, growth, development of their children later in life (8). Anaemia during adolescence affects the growth and development of girls, diminishes their concentration in daily tasks, limits their learning ability, increases their vulnerability to dropping out of school, causes loss of appetite resulting in reduced food intake and irregular menstrual cycles, and reduces physical fitness and future work productivity. Moreover, anaemia during adolescence influences women's entire life cycle since anaemic girls will have lower pre-pregnancy iron stores. As pregnancy is too short a period to build the iron stores required to meet the needs of the growing foetus, women who enter pregnancy anaemic are at an increased risk of giving birth to children with a low birth weight (below 2,500 grams), delivering pre-term newborns, and/or dying while giving birth. Additionally, children born to anaemic women are more likely to die before the age of one year and be sick, undernourished and anaemic, thus perpetuating the intergenerational cycle of maternal and child under nutrition(9).Hence, investing in preventing anaemia during adolescence is critical for adolescent girls themselves as well as for the survival, growth and development of their children later in life (10).

58 Globally, one in three non-pregnant women, corresponding to almost 500 million, was anaemic in
59 2011(11). Iron deficiency is thought to contribute to at least half of the global burden of anaemia. Iron
60 deficiency occurs following prolonged negative iron balance, the major causes of which include
61 inadequate intake owing to insufficient bio-available iron in the diet or decreased iron absorption,
62 increased iron requirements (for instance, during periods of growth) and chronic blood loss (from
63 heavy hookworm infection or menstrual bleeding (12). In adolescent girls, menstrual blood losses,
64 accompanied by rapid growth with expansion of the red cell mass and increased tissue iron
65 requirements, make them particularly vulnerable to iron deficiency compared to male counterparts
66 (13).

67 The informative & educable intervention definitely has a positive effect on awareness levels which
68 would eventually encourage expansion of knowledge & positive health habits (14).Information,
69 Education and Communication (IEC) combines strategies, approaches and methods that enable
70 individuals, families, groups, organizations and communities to play active roles in achieving,
71 protecting and sustaining their own health.In other words IEC is the process of learning that
72 empowers people to make decisions, modify behaviours and change social conditions. Activities are
73 developed based upon needs assessments, sound educational principles, and periodic evaluation
74 using a clear set of goals and objectives (15). Further, timely and quality communication with
75 adolescent girls, their families and communities about the consequences of anaemia, the benefits of
76 the anaemia control programme, and the potential undesirable side-effects of supplementation and
77 deworming and how to mitigate them is essential to ensure girls' adherence to the programme.
78 Communication strategies focusing on the benefits of the programme for adolescents' health and
79 school performance seem to be the most effective (16).

80 The present study therefore is an endeavour to assess the effectiveness of an intervention
81 programme for reducing the incidence of anaemia among adolescent girls. The intervention is an IEC
82 module (Information Education Communication) that was applied among adolescent school girls in
83 the state of Uttarakhand. The study was planned with the following objectives:

- 84 (i) To improve the knowledge of adolescent school girls in the area of basic nutrition,
85 anaemia, health and hygiene.
- 86 (ii) To sensitise the respondents about anaemia as a serious health issue, its symptoms,
87 identification, impact and control.

88 (iii) To motivate the adolescent school girls to adopt best practices with reference to correct
89 food habits, cooking techniques, personal and family hygiene as a means for combating
90 the problem of anaemia.

91 (iv) To evaluate the **impact** of IEC programme on haemoglobin level, and knowledge, attitude
92 and practices of the subjects.

93 **2. MATERIALS AND METHODS:**

94 **2.1 Locale:**

95 The present study was carried out in Uttarakhand state of India that has a total of 13
96 districts. Uttarakhand is one of the special states of the country having total area of 53,483 sq km.
97 Currently population density of Uttarakhand is 189 per Sq.km. Uttarakhand is located on the foothills of
98 the Himalayan mountain ranges. The state has diverse geographical features ranging from snow-
99 capped mountain peaks in the North to tropical forests in the South; its climate and vegetation vary
100 accordingly. About 93 percent of the area is hilly, and the remaining 7 percent is covered by plains.
101 Women are considered as the backbone of hill economy in Uttarakhand. In rural areas, women are
102 contributing up to 90 percent of the total work in agriculture and animal care. The participation rate of
103 women in the economy of the state is much higher than several other states. **In the present study two**
104 **districts;** Udham Singh Nagar and Nainital were taken up. The experimental group was taken from
105 Government High Schools of Nagla and Shantipuri of Udham Singh Nagar district while the control
106 group was taken from Government High School Haldachaur of Nainital district. The selected districts
107 come under Tarai region of the Uttarakhand state. **Different locations were selected so that control**
108 **group would not be influenced by experimental group, and cross pollination would be checked.**
109 **Subjects of both the locations had similar socioeconomic status and cultural background.**

110 **2.2 Ethical consent:**

111 Prior to the initiation of the study ethical clearance was obtained from the University Ethical
112 Committee of Govind Ballabh Pant University of Agriculture and Technology. Further informed
113 consent was taken from each subject's parents prior to initiation of the study.

114 **2.3 Sample Characteristics:**

115 **According to NFHS- 4,** in Uttarakhand women constitute 48.99 percent of the total population. In the
116 state, 91 percent of adolescent girls are affected by any form of anaemia. Twenty three percent of

them are mildly anaemic, 39 percent are moderately anaemic and 29 percent are having severe anaemia. For the present study rural adolescent girls in the age between 13-16 years of government high schools of Nagla and Shantipuri of Udham Singh Nagar district (experimental group) and Halduchaur of Nainital district (control) were selected for the study. Rural means an area where a population of less than 5,000, density of population less than 400 per sq km and more than "25 per cent of the male working population" is engaged in agricultural pursuits. Actual age of the students was recorded from school registers. Girls were chosen for the present study because it is an established fact that anaemia is a major health problem among adolescent girls. Girls whose Hemoglobin levels were above 12g/ dl or whose parents did not give consent for the study were excluded. Anaemic girls in the study area were eligible for the study.

2.3.1 Screening of subjects:

The inclusion criteria for screening of the subjects for the present study were as follows:

The subjects had to be rural adolescent girls in the age group between 13-16 years, having haemoglobin level up to 11.9 g /decilitre. All participants required to obtain written consent from their parents/ guardians to be included for in the study.

400 adolescent girls were screened for the study to obtain the required sample size of 300. The sample size of 300 was arrived using formula

$$n = \frac{t^2 \times p(1-p)}{d^2}$$

Where, t= confidence level at 95 % (standard value 1.96)

n = Required sample size

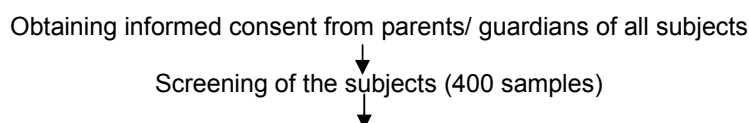
P_{expected} = Expected prevalence of anaemia

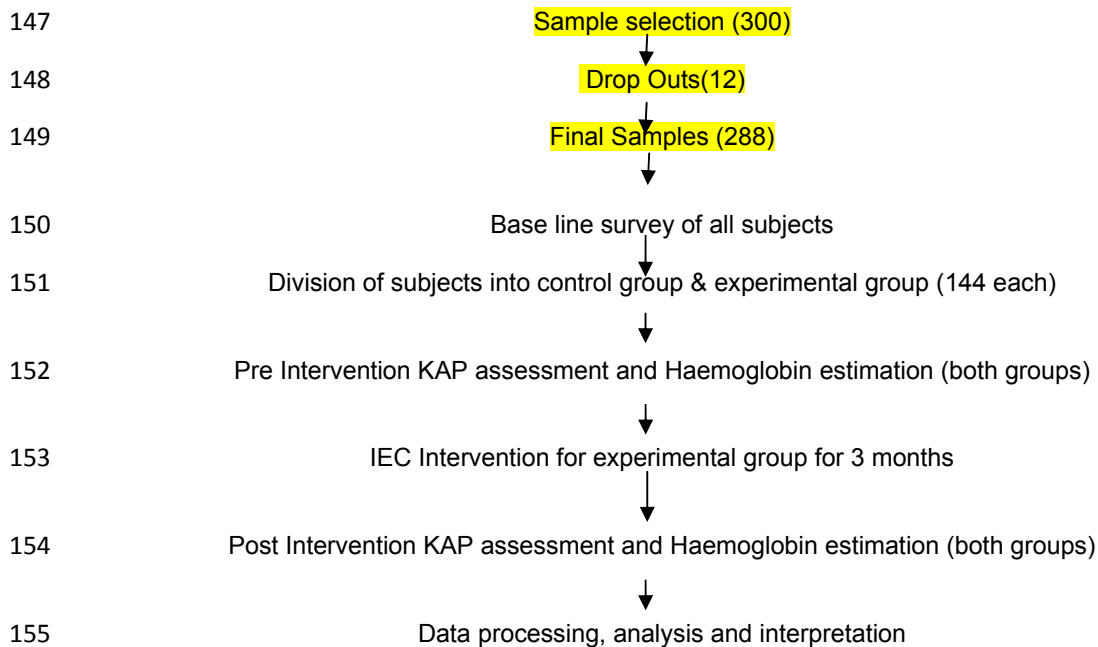
d² = Desired absolute precision

How ever there was a drop out of 12 subjects due to discontinuation of their studies in the middle of the intervention programme. Therefore the final sample size came to 288 respondents. Subjects were divided in 2 groups, experimental and control group, each having 144 girls.

2.4 Research Design: Concurrent parallel study design

The Flow chart of the research design:





157 Subjects of experimental group were given IEC intervention for a period of 3 months while those of
158 control group were not given any IEC intervention. Haemoglobin levels and knowledge, attitude and
159 practices (KAP) scores were recorded (using pre-validated questionnaire) before IEC programme in
160 both the groups. Post IEC programme, haemoglobin and KAP scores were again recorded in both the
161 groups.

162 **2.5 Tools developed and equipments used:**

163 Baseline Survey Questionnaire: A comprehensive pre tested questionnaire was utilized to collect
164 information regarding the socio economic status, family data, food habits, morbidity pattern and
165 menstrual information of each of the 288 respondents.

166 KAP Questionnaire: A Knowledge, Attitude and Practices (KAP) survey is a quantitative method
167 (predefined questions formatted in standardized questionnaires) that provides access to quantitative
168 and qualitative information. KAP surveys reveal misconceptions or misunderstandings that may
169 represent obstacles to the activities that one would like to implement and potential barriers to
170 behaviour change. A pretested closed ended questionnaire having 30 questions in each component
171 with yes/no type and multiple choice answers was used to assess the knowledge, attitudes and
172 practices (KAP) regarding anaemia and general health issues among the 288 subjects, both before
173 and after the IEC intervention. The questions of the KAP schedule were assigned scores. Score 1 for
174 the correct and 0 for the wrong answer. Thus mean score for each component was obtained. Each

component (of KAP) was equally weighted and validated.KAP scorers were blinded as the subjects were not aware of the scores.

Equipments used: A portable haemoglobin meter (model no. L7113P) and Mission Hb haemoglobin test strips from M/S Labtronics,Plot no. 76. Phase II, Industrial area, Panchkula, Haryana, were used for estimation of haemoglobin of blood samples both before and after the IEC intervention.

2.6 IEC Intervention: 144 subjects of experimental group were given 12 IEC messages in the form of Discussions, lectures, trainings, demonstrations, video films and slide shows. No IEC programme was conducted in control group.12 IEC messages listed in the methodology formed the curriculum for the intervention. Tools used for delivering the messages were lectures, trainings, method demonstrations, video films and slide shows. A module has been developed for replication of the intervention.

The following 12 topics were covered under the IEC programme.

1. Healthybody/Healthy human being: components constituting health; Body-Height/weight/body composition; Standards for specific age
2. Food groups and its function
3. Nutrients in food and their role and requirement for adults
4. Food groups and balanced food pyramid
5. Nutrient deficiency symptoms
6. Anaemia and its relation to food and nutrients
7. Anaemia causes, symptoms and preventive measures
8. Prophylactic programme to combat anaemia
9. Dietary supplement/cooking methods/fortification through daily diet food
10. Hygiene and sanitation
11. Preservation of nutrients
12. Government programmes on nutrition

The researchers were allocated regular class periods for carrying out intervention programmes ensuring uniformity in the time spent for conducting the IEC. No nutrition supplementation programme was going on during the study.

2.7 Statistical analysis: Simple statistical tools like mean and standard deviation were used to process data for statistical analysis. Paired-t test ($P=0.05$) was applied using MS Excel to compare the pre and post intervention haemoglobin level and knowledge, attitude and practices scores (regarding anaemia) of adolescent girls in order to assess the effectiveness of planned IEC intervention. Further, Z test for two means was applied for comparing base line and end results between experimental and control group for parameters like haemoglobin and KAP at 95 % confidence interval.

3. RESULTS AND DISCUSSION:

3.1 Results:

3.1.1 Effect of IEC programme on knowledge, attitude and practices related to anaemia among adolescent girls:

The IEC intervention focussed on the association between knowledge, attitude and practices of the respondents in relation to their health. Knowledge can be defined as the fact or condition of being aware or familiar with a subject. Attitude is mental position with regard to a fact or state. On the other hand practice is the usual way of doing something. For adolescent girls nutritional education should be provided through schools, other organizations, marketplaces or workplaces. Health promotion should be based on research that has identified cultural and institutional constraints and detrimental attitudes and practices (14).

3.1.1.1 Knowledge:

Regarding baseline difference with respect to knowledge scores between experimental and control group, a non significant difference was found which is evident from the z calculated value (1.58) as seen from table 1. In contrast the difference between post score of knowledge between 2 groups was found significant (z calculated: 3.15) (Table 1).

In experimental group, mean score of knowledge regarding anaemia in pre and post IEC programme was found to be 7.08 and 8.42, respectively. A percent increase of 18.93 was observed after the IEC intervention programme in experimental group which indicated a positive effect of the intervention though statistically it was a non significant change. Whereas in control group, a percent decrease of 3.71 was observed with decrease in mean scores of knowledge from 7.55 to 7.27 after the study (Table 1).

3.1.1.2 Attitude:

With respect to baseline and post IEC scores of the attitude, a non significant difference was observed between experimental and control group (Table 1). Regarding attitudes of the subjects, in experimental group, the mean score for attitudes increased from 5.74 to 6.13 or an increase of 6.79 percent, occurred post IEC intervention. However change in attitude score was found statistically non significant. On the other hand, in the control group, mean score for attitude decreased from 6.48 to 6.16 with percent decrease of 4.93 (Table1).

3.1.1.3 Practice:

A non significant difference was observed with respect to baseline practice score between the experimental and control group, while a significant difference (z calculated value: 1.98) was observed between the groups with respect to end results. In experimental group mean score for practices increased from 8.65 (Pre IEC programme) to 9.04 (Post IEC programme) with percent increase of 4.51 percent. Whereas in control group, a decrease in mean score from 8.45 to 8.30 was observed with percent decrease of 1.78 percent (Table1). The changes in practice score in both the groups was found not significant.

247 Table. 1 Mean KAP scores of the subjects

Groups	Mean KAP Scores											p v a l u e	
	Knowledge				Attitude					Practice			
	Pre score	Post score	% ch an ge	p valu e	Pre sco re	Pos t scor e	% c h an g e	p val ue	Pre sc ore	Po st sc ore	% cha nge		
Experimental group (n=144)	7.08±1 .54	8.42±1 .64	18. 93 (+)	1.76 118 E- 13 ^{NS}	5.7 4±1 .67	6.13 ±1.6 5	6. 7 9(+)	0.0 13 41 1 NS	8.6 5± 1.3 8	9.0 4± 1.2 9	4.5 1(+)	0 .0 0 4 NS	
Control group (n=144)	7.55±1 .65	7.27±1 .87	3.7 1 (-)	0.02 674 467 NS	6.4 8±1 .60	6.16 ±1.7 6	4. 9 3 (-)	0.0 16 68 6 NS	8.4 5± 1.5 8	8.3 0± 2.1 5	1.7 8 (-)	0 .1 7 NS	
Z value calculated at 95 % confidence interval(confi	1.58 ^{NS}	3.15 ^S			- 1.3 6 ^{NS}	- 0.08 7 ^{NS}			0.7 7 ^{NS}	1.9 8 ^S			

dence limits:												
±1.96)												

+ means increase, - means decrease, NS-Non significant, S-significant at 95% confidence interval

3.1.2 Effect of IEC intervention on haemoglobin levels of the subjects:

Mean haemoglobin level of experimental group was found to be 10.39±1.18 g/dl and 11.33±1.11g/dl in pre and post IEC programme, respectively. In control group haemoglobin (Hb) content decreased from 10.39±1.12 to 10.36±1.75 g/dl after study. Percent increase of 9.05 in Hb level of experimental group was observed and it was found statistically significant (at p=0.05), whereas in control a slight decrease of 0.29 percent was observed in haemoglobin level after the study that was found non significant (Table 2).

Table .2 Haemoglobin levels (Mean±SD) of subjects

Groups	Pre Hb(g/dl)	Post Hb (g/dl)	% change	P value
Experimental group (n=144)	10.39±1.18	11.33±1.11	9.05(+)*	0.63 ^S
Control group (n=144)	10.39±1.12	10.36±1.75	0.29(-) ^{NS}	0.02 ^{NS}

+ means increase, - means decrease, * means significant at P=0.05, NS means non significant

3.1.2.1 Categorization of the subjects as per the classification of anaemia (WHO):

Subjects of both experimental and control group were categorized as per the classification of anaemia by World Health Organization. In pre IEC period 68.06 percent subjects of experimental group were affected by mild anaemia (Hb: 10-11.9g/dl), Further 30.55 percent subjects were found to be moderately anaemic (Hb:7-9.9g/dl), whereas 0.69 percent subjects of experimental group were severely anaemic (Hb:<7g/dl)

In post IEC period, haemoglobin level of the experimental group improved, as 27.08 percent subjects attained normal haemoglobin level (Hb: ≥12g/dl) and the percentage of the subjects having mild anaemia also decreased to 61.8 percent against 68.06 percent in pre IEC programme. Similarly the percentage of the subjects having moderate and severe anaemia came down to 11.11 and 0 percent respectively, post IEC programme (Table 3).

In control group, proportion of the subjects falling in normal haemoglobin category increased from 0 to 18.75 percent, whereas proportion of the subjects having mild anaemia decreased from 65.97 percent

to 47.22 percent. Further, percentage of the subjects having moderate anaemia increased from 33.33 to 34.03 percent after the study (table3).

Table.3 Categorization of subjects as per the classification of anaemia

Classification of anaemia	Hb level(g/dl)	Experimental group (n=144)				Control group (n=144)			
		Pre	Percent	Post	Percent	Pre	Percent	Post	Percent
Normal	≥12	-	-	39	27.08	-	-	27	18.75
Mild	10-11.9	98	68.06	89	61.8	95	65.97	68	47.22
Moderate	7-9.9	45	30.55	16	11.11	48	33.33	49	34.03
Severe	<7	1	0.69	-	-	-	-	-	-

3.2 DISCUSSION:

Anemia is a major public health problem prevalent among almost all age groups. An adolescent girl is 10 times more likely to develop anemia than a boy. Teenagers are at the highest risk of anemia during their adolescent growth spurt. Among girls, however, menstruation increases the risk for iron deficiency anemia throughout their adolescent and childbearing years (17).

To combat the problem, strategies that have been adopted globally include supplementation and fortification. Both of these strategies have been successful at various levels but there has been a little progress in anemia control due to various reasons like lack of awareness and education, faulty cooking practices, unwillingness to eat supplements. Thus there is a need for a strategy that can be sustainable and effective. It is with this understanding that the present study was formulated in order to control the prevalence of anaemia in the Tarai region of Uttarakhand state. In the present study effectiveness of the IEC intervention programme for mitigation of anaemia among rural adolescent girls was evaluated. In the experimental group, knowledge, attitudes and practice scores improved as compared to baseline scores of the subjects. It was reflected by increase of 18.93 percent in knowledge score, 6.79 percent increase in attitude score and 4.51 percent increase in practice score of the subjects. However, the change in KAP scores in both the groups was found statistically non significant. Use of educational aids for intervention have a positive effect on the nutritional knowledge of girls which may ultimately improve their nutritional status (18). The findings of the present study are in line with a study that found that IEC programme is beneficial for improving awareness regarding

health and nutrition in women subjects (19). Another study reported the Nutrition education intervention has an impact on improving knowledge, attitude and practices of iron-deficient female adolescents compared with control (20).

Further, a significant positive improvement was observed on the haemoglobin levels of the respondents after intervention in experimental group, whereas in control group non significant changes in haemoglobin levels were observed. Similar results have been reported in the following studies. IEC intervention showed a positive effect on haemoglobin level of adolescent girls (21). Further, IEC intervention reflected the positive effects in terms of reducing the severity of anaemia as higher proportion of the subjects obtained the normal haemoglobin levels. Under a national programme, use of supplementation and IEC training to women and children resulted in increased haemoglobin levels in general by 15-20g/dl in a year and the prevalence of severe anaemia decreased in Uzbekistan (22).

4. CONCLUSION:

From the results of the study it may be concluded that IEC programme had a favourable effect on haemoglobin levels of the experimental group as the proportion of subjects having normal haemoglobin levels increased significantly from 0 to 27.08 percent and percentage of subjects having moderate anaemia was decreased from 30.55 percent to 11.11 percent post IEC programme. In contrast in the control group non significant changes were observed with respect to haemoglobin level and KAP scores. India has been struggling to control the problem of anaemia for the past many years through concentrating national level programmes such as the Anaemia Prophylaxis Programme; however not much success has been achieved in this direction. The present study goes to show that IEC intervention can help in anaemia control to some extent. In order to obtain significant positive effect on KAP scores, duration of IEC intervention may need to be extended. This information is of relevance for policy planners at the national and international level who are working to eradicate anaemia.

COMPETING INTERESTS:

Authors declare that there are no competing interests exist.

CONSENT:

All authors declare that 'written informed consent was obtained from the patient (or other approved parties) for publication of this case report and accompanying images. A copy of the written consent is available for review by the Editorial office/Chief Editor/Editorial Board members of this journal.

ETHICAL APPROVAL:

All authors hereby declare that all experiments have been examined and approved by the appropriate ethics committee and have therefore been performed in accordance with the ethical standards laid down in the 1964 Declaration of Helsinki.

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