

COVID-19 PREVENTION AND CONTROL: A STUDY OF THE KNOWLEDGE, AWARENESS AND ATTITUDE TOWARDS THE DISEASE AMONG RADIOLOGY DEPARTMENTS STAFF IN SUDAN

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ABSTRACT

Introduction. In the wake of the current situation of the COVID-19 pandemic, it is important to strictly follow all the standard infection prevention and control measures (SICPs) of the World Health Organization (WHO). SICPs is a scientific approach and practical solution designed to prevent harm caused by infection to patients and health workers.

Objective. This study aimed to evaluate the knowledge and practice of standard measures of IPCs among the staff of the radiology departments in Sudan.

Material and methods. A qualitative survey was conducted using a questionnaire distributed via email among radiology staff in thirty-three different hospitals in Sudan. The questionnaire was developed by the authors, with help from scientific literature to cover key areas of knowledge, awareness and attitude regarding infection prevention and control guidelines of COVID-19.

RÉSUMÉ

Prévention et lutte contre les infections à COVID-19: étude des connaissances, de la conscience et de l'attitude de la maladie chez le personnel des départements de radiologie au Soudan

Introduction. Dans le sillage de la situation actuelle de la pandémie de COVID-19, il est important de suivre strictement toutes les mesures de prévention et de contrôle des infections (IPC) normalisées par l'Organisation Mondiale de la Santé (OMS). L'IPC est une approche scientifique et une solution pratique conçue pour prévenir les dommages causés par l'infection aux patients et aux agents de santé.

L'objectif de l'étude. Cette étude visait à évaluer les connaissances et la pratique des mesures standard d'IPC parmi le personnel des services de radiologie au Soudan.

Matériel et méthodes. Une enquête qualitative a été menée à l'aide d'un questionnaire distribué par

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Results. A total of 68.3% of the study group knew the guidelines established by WHO to deal with COVID-19 patients or suspected cases. 65% of the respondents had previous training in hand hygiene and about 75% of them had sufficient knowledge in hand hygiene, observed during their routine clinical practices. 69.2% of respondents used portable imaging equipment to limit the transportation of COVID-19 patients and 69.2% were aware that the patients were wearing a surgical mask when entering and leaving the radiology department.

Conclusions. The radiology departments staff in Sudan is fairly aware of SICPs. They are strictly following standard guidelines for infection, prevention and management of COVID-19 issued by WHO.

Abbreviation list:

IPC - infection prevention and control
 WHO - World Health Organization
 HAIs - healthcare-associated infections
 SICPs - standard infection control precautions
 IC - infection control

INTRODUCTION

Infection prevention and control (IPC) is a scientific approach and practical solution designed to prevent harm caused by infection to patients and health workers. It is grounded in infectious diseases, epidemiology, social science, and health system strengthening. IPC occupies a unique position in the field of patient safety and quality universal health coverage, since it is relevant to health workers and patients at every single health-care encounter (WHO, 2020)¹.

Infection control concerns the control of the spread of healthcare-associated infections (HAIs) developed by patients who receive care and it is imperative in maintaining patient safety by reducing the effects of HAIs on the health of patients^{2,3}. HAIs are caused by pathogenic microorganisms that can be detected in the air, water, and even on surfaces. The modes of spread of HAIs include direct, indirect and airborne contacts⁴.

According to a 2006-2007 survey of more than 1000 interventional radiologists, only 44% reported participating in IPC training before initiating practice, so IPC education is lacking among radiology staff. Approximately 50% of those surveyed consistently used protective eyewear, face masks, or face shields during

courrier électronique auprès du personnel de radiologie de trente-trois hôpitaux différents au Soudan. Le questionnaire a été développé par les auteurs avec l'aide de la littérature précédente pour couvrir les principaux domaines de connaissances, de sensibilisation et d'attitude concernant les directives de prévention et de contrôle des infections de COVID-19.

Résultats. Un total de 68,3% du groupe d'étude connaissait les lignes directrices établies par l'OMS pour traiter les patients COVID-19 ou les cas suspects. 65% des personnes interrogées avaient une formation préalable en hygiène des mains et environ 75% d'entre elles avaient des connaissances suffisantes en hygiène des mains observées lors de leurs pratiques cliniques de routine. 69,2% des répondants ont utilisé un équipement d'imagerie portable pour limiter le transport des patients atteints de COVID-19 et 69,2% savaient que les patients portaient un masque chirurgical lorsqu'ils entraient et sortaient du service de radiologie.

Conclusions. Le personnel des services de radiologie au Soudan est assez au courant des mesures standard de l'IPC. Ils suivent strictement les directives standard de prévention et de gestion des infections de COVID-19 publiées par l'OMS.

Mots-clés: coronavirus, COVID-19, infection, radiologie.

interventions. Furthermore, only 71% of needle stick injuries were reported to employee health services⁵.

As radiologists, radiographic technologists, computed tomography (CT) and magnetic resonance imaging (MRI) technologists, sonographers, nuclear medicine technologists, radiology nurses and receptionists in a radiology department, we have direct contact with patients and other hosts, being at a high risk of contracting and spreading infections. The risk of infection can occur during patient registration, recording of history, clinical examination, transportation, radiologic examination or in the waiting area. Standard infection control precautions (SICPs) should, therefore, be adhered to prevent these infections. Thus, all of the staff mentioned require acceptable knowledge levels, as well as adequate practices related to infection control to prevent the effects of HAIs on healthcare workers and patients health safety. Current data highlight the need for a concise relevant guide to ICP, that is pertinent to current radiology practice. The recent pandemics of COVID-19 underscore the need for all clinical personnel, including radiologists, radiographic technologists, sonographers, nuclear medicine technologists, and nurses in a radiology department, to have an understanding of proper prevention and control practices.

THE OBJECTIVE OF THE STUDY was to evaluate the knowledge and practice of standard measures of IPCs among the staff of the radiology departments in Sudan.

MATERIAL AND METHODS

A descriptive qualitative survey was carried out among all workers in the radiology departments in thirty-three hospitals (governmental, general, university and private hospitals) in Sudan. This survey questionnaire was distributed to all the workers in the radiology departments via email. The questionnaire was developed by researchers with help from recent scientific literature, to cover key areas of knowledge, awareness, and attitude regarding IPC guidelines in a radiology department, including standard IPC precautions in cases of COVID-19, hand hygiene, respiratory hygiene, knowledge about cough etiquette, use of personal protective equipment, cleaning and disinfection of radiological equipment, as well as their satisfaction with their IPC teaching and education. Data entry was done through Google form. Data were analyzed using SPSS version 16 (SPSS Inc., Chicago, IL, USA) and percentages were calculated for the entire variables.

RESULTS

One hundred and twenty questionnaires were sent out to all employees in the radiology departments in thirty-three hospitals during the period from March 2020 to April 2020. The study group was categorized according to specialty, experience, and infection control background. The respondents included 6 radiologists, 61 radiographic technologists, 33 sonographers, 10 CT technologists, 5 MRI technologists, 3 nuclear medicine technologists, 1 radiology nurse and 1 radiotherapist. The distribution according to the experience was: 57 (47.5%) with experience less than 5 years, 30 (25%) with experience between 6-8 years, 17 (14.2%) with experience between 9-12 years, 5 (4.2%) with

Table 1. Demographic data and general characteristics of the study group.

Questions	Response (n; %)
Age	
20-30 years	(75; 62.5%)
31-40 years	(28; 23.3%)
41-50 years	(13; 10.8%)
≥ 51 years	(4; 3.3%)
Gender	
Male	(59; 50.8%)
Female	(61; 49.2%)
Specialty	
Radiologist	(6; 5%)
Radiographic technologist	(62; 50.8%)
Ultrasound technologist	(33; 27.5%)
MRI technologist	(5; 4.2%)
CT technologist	(10; 8.3%)
NM technologist	(3; 2.5%)
Radiology nurse	(1; 0.8%)
Radiotherapist	(1; 0.8%)
Years of experience	
≤5 years	(57; 47.5%)
6-8 years	(30; 25%)
9-12 years	(17; 14.2%)
13-16 years	(5; 4.2%)
17-20 years	(9; 7.5%)
≥21 years	(2; 1.7%)
Type of hospital	
General hospital	(35; 29.2%)
Private hospital and radiology diagnostic center	(43; 37.5%)
Governmental hospital (e.g Military and Police Hospital)	(24; 20%)
University hospital (e.g Teaching Hospital)	(16; 13.3%)

A total of 74.8% of the study group were aware of the standard SICPs within the health care system and 82.5% aware of the SICPs within the radiology department (Table 2).

Table 2. Awareness of radiology staff about the SICPs.

Questions	Response in (n; %)		
	Total number responded (n)	Number responded Yes (n; %)	Number responded No (n; %)
Are you aware of the standard infection control precautions within the health care system?	119	(89; 74.8%)	(30; 25.2%)
Are you aware of the standard infection control precautions within the radiology department?	120	(99; 82.5%)	(21; 17.5%)

A total of 78 respondents (65%) had previous training in hand hygiene, while 90 (75%) had sufficient knowledge about hand hygiene, and hand hygiene is embedded in their routine clinical practice. A total of 64 respondents (53.3%) were aware that a minimum of 15 seconds is needed for adequate hand hygiene and only 50 respondents (41.7%) wash their hands before and after each patient's encounter (Table 3).

Table 3. Knowledge, awareness of radiology staff about hand hygiene

Questions	Response in (n; %)		
	Total number responded (n)	Number responded yes (n; %)	Number responded no (n; %)
Have you had hand hygiene training?	120	(78; 65%)	(42; 35%)
Do you have sufficient knowledge about hand hygiene?	120	(90; 75%)	(30; 25%)
Is hand hygiene embedded in your professional practice?	120	(77; 64.2%)	(43; 35.8%)
What is the minimum time needed for hand washing?			
5 Seconds		(2; 1.7%)	
10 Seconds	120	(13; 10.8%)	(0; 0%)
15 Seconds		(64; 53.3%)	
1 Minute		(38; 31.7%)	
2 Minutes		(3; 2.5%)	
Do you wash your hands before and after each patient's encounter?			
Yes	120	(50; 41.7%)	(0; 0%)
No		(21; 17.5%)	
Only before		(3; 2.5%)	
Only after		(46; 38.3%)	

Regarding knowledge of respiratory hygiene and cough etiquette, 115 respondents (95.8%) were aware of the protocol to cough and sneeze on a mask or tissue and 106 (88.3%) were aware of using special containers for disposing the mask and tissue after coughing or sneezing; also, regarding respiratory hygiene and cough etiquette, only 106 (88.3%) were aware of using their shoulder or elbow as alternative method if tissue or mask is not available and 110 (91.7%) were aware about the optimum distance that should be kept from others when sneezing/coughing. The results also show a mixed knowledge regarding the use of N95 and face mask (Table 4).

Table 4. Knowledge, awareness and attitude of radiology staff regarding respiratory hygiene and cough etiquette

Questions	Response in (n; %)			
	Total number responded (n)	Number responded Yes (n; %)	Number responded No (n; %)	Number responded I don't know (n; %)
Nose and mouth should be covered when coughing/sneezing with tissue or mask?	120	(115; 95.8%)	(3; 2.5%)	(2; 1.7%)
Mask and tissue should be disposed of after usage in special containers?	120	(106; 88.3%)	(4; 3.3%)	(10; 8.3%)
Cough/sneeze over the shoulder or elbow if tissue or mask is not available	120	(106; 88.3%)	(10; 8.3%)	(4; 3.3%)
Keep a distance of 1 meter (3 feet) from others when coughing/sneeze	120	(110; 91.7%)	(9; 7.5%)	(1; 0.8%)
Is it recommended for radiology staff to wear N95 respirators to protect themselves?	120	(80; 66.7%)	(24; 20%)	(16; 13.3%)
Is it recommended for healthy people to wear a face mask to protect themselves?	120	(83; 69.2%)	(35; 29.2%)	(2; 1.7%)

A total of 82 respondents (68.3%) of the study group knew the guidelines established by the WHO to deal with COVID-19 patients or suspected COVID-19 people. A total of 74 (61.7%) respondents confirmed that WHO infection control and prevention guidelines for COVID-19 are available in their departments. In addition, the knowledge of respondents regarding the transmission of COVID-19 and the use of strict infection control procedures when interacting with COVID-19 cases was relatively high, a total of 83 respondents (69.2%) use portable imaging equipment to limit the transportation of COVID-19 patients, 83 (69.2%) were aware that the patients should wear a surgical mask when entering and leaving the radiology department. However, 91 respondents (75.8%) were aware of wearing disposable, fluid-resistance isolation gown, disposable gloves with coverage cuffs, face mask over goggles, and eye protection when dealing with COVID-19 patients. Regarding disinfectants, more than 90% of radiology staff were aware of using disinfectants for cleaning the equipment after uses for imaging COVID-19 patients or suspect COVID-19 cases, to decrease the infection transmission of coronavirus. A total of 108 respondents (90%) use disinfectant after every procedure for suspected or confirmed COVID-19 cases (Table 5).

Table 5. Knowledge, awareness and attitude of radiology staff in COVID-19 patients or suspected COVID-19 cases

Questions	Response in (n; %)		
	Total number responded (n)	Number responded Yes (n; %)	Number responded No (n; %)
Do you know about the guidelines established by the WHO to deal with COVID-19 patients or suspected COVID-19 cases?	120	(82; 68.3%)	(38; 31.7%)
Are the WHO infection control and prevention guidelines for COVID-19 available in your department?	120	(74; 61.7%)	(46; 38.3%)
Should portable imaging equipment use to limit the transportation of patients with COVID-19 or suspected COVID-19 to reduce the infection?	120	(83; 69.2%)	(37; 30.8%)
The COVID-19 patients should wear a surgical mask when entering and leaving the radiology department?	120	(83; 69.2%)	(37; 30.8%)
The radiology department staff should wear eye protection with a face mask over goggles when dealing with COVID-19 patients or suspected COVID-19?	120	(91; 75.8%)	(29; 24.2%)
The radiology department staff should wear disposable, fluid-resistance isolation gown when dealing with COVID-19 patients or suspected ones?	120	(101; 84.2%)	(19; 15.8%)
The radiology department staff should wear disposable gloves with coverage cuffs when dealing with COVID-19 patients or suspected ones?	120	(110; 91.7%)	(10; 8.3%)
The disinfectant should be used after contact with every COVID-19 patient or suspected COVID-19	120	(108; 90%)	(12; 10%)
The disinfectant should be used for cleaning image viewing station, mouse and keyboard after contact with COVID-19 patient or suspected COVID-19	120	(108; 90%)	(12; 10%)
The disinfectant should be used for cleaning ultrasound probes, tables, gantries after contact with COVID-19 patient or suspected COVID-19	120	(110; 91.7%)	(10; 8.3%)

When radiology staff was asked about satisfaction with their training in basic IPC, 95 (79.16%) were satisfied about the basic infection prevention and control training (Figure 1) and 97 (80.8%) believed that classmates and/or senior doctors act as role models of the practices of IPC (Figure 2).

experience between 13-16 years, 9 (7.5%) with experience between 17-20 years, and 2 (1.7%) with experience over 21 years (Table 1).

DISCUSSION

In the wake of the current situation of the COVID-19 pandemic, it is important to strictly follow all the IPC measures standardized by WHO. The study revealed that the radiology staff of different private, government and allied hospitals had a good understanding of the precautionary measures required for IPC. A large proportion of the staff (47.5%) had experience <5 years, yet their awareness regarding standard IPC measures was high. Around 115 respondents (95.8%) had good insight regarding the use of personal protective equipment to limit the transmission of virus, which is far greater than the average level of knowledge about IPC among radiographers in Ghana, Sri Lanka, and South-east Nigeria,

revealed by similar studies (studies evaluating 51 radiographers in South-east Nigeria, 27 government hospitals in Malawi etc). 82.5% of staff members were aware of the SICPs within the radiology department. Departments also practiced modern techniques, such as portable radiographic imaging equipment, to limit the transportation of COVID-19 patients. A cross-sectional study through a reliable questionnaire including sociodemographic and Middle East Respiratory Syndrome (MERS-CoV) knowledge data of 384 participants in Al-Jouf government concluded that the majority of the participants showed generally moderate knowledge about COVID-19. The public awareness and knowledge about the nature, communicability, and lethal effect of the disease were good, overall; however, knowledge about the incubation period of the virus, clinical picture, and epidemiology of the disease needs more governmental concern and frequent communication between healthcare providers and both school students and non-educated

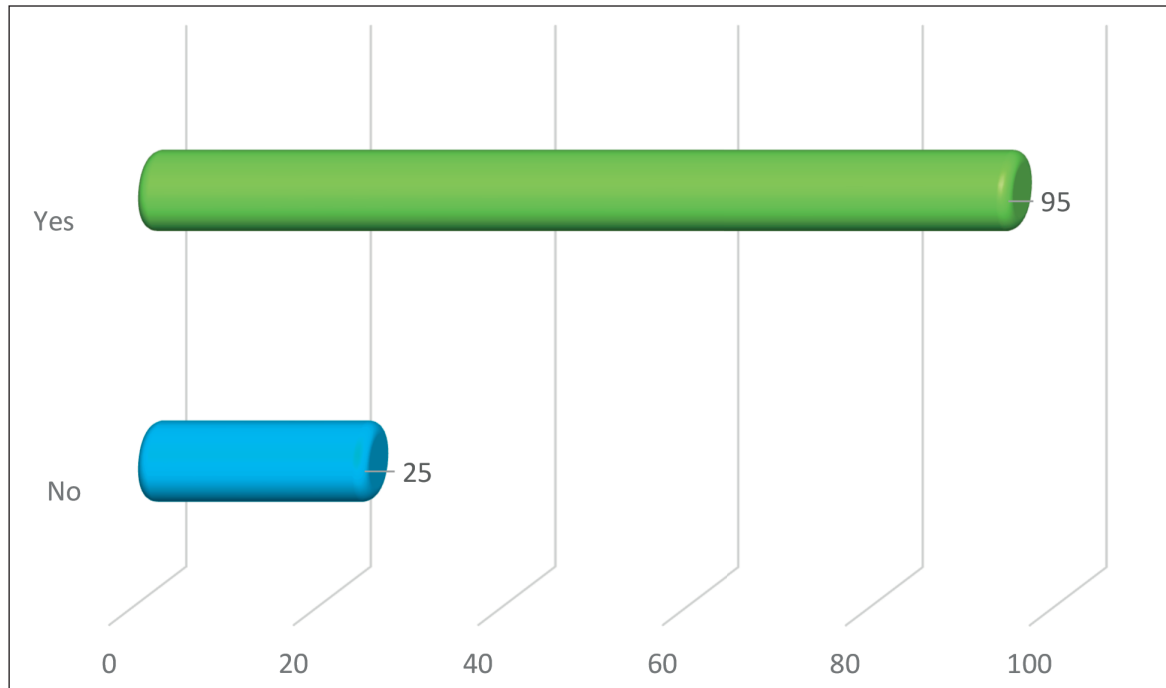


Fig 1. The satisfaction of staff regarding basic IPC in the radiology departments

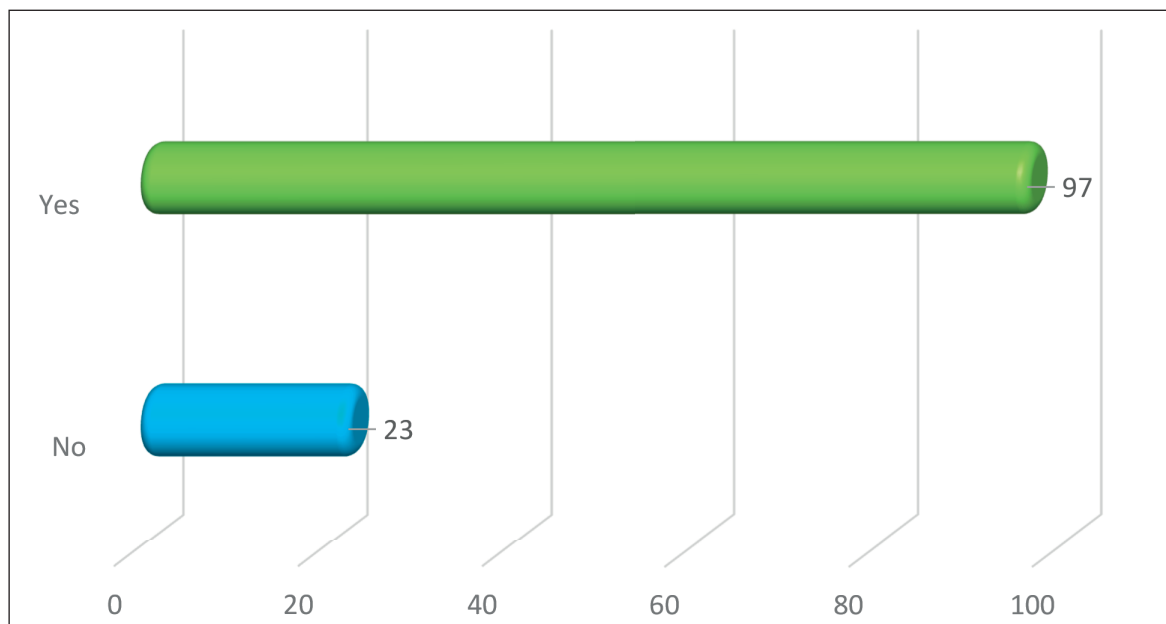


Fig 2. The satisfaction of staff regarding classmates or senior medical staff acts as role models in the practices of infection prevention.

individuals, by the help of Saudi government, to control the disease outbreak⁶.

This study reported a high level of knowledge of our studied sample. A study done in Al-Hassa Governorate reported that only 61% of participants were aware of ICPSs guidelines. In addition, in Saudi Arabia, it was reported a lack of knowledge of infection control measures by healthcare workers in

hospitals, as well as at the primary care level. This difference may be due to the high percentage of infection control training courses in our participants. Also, it may be due to the performance of other studies in Saudi Arabia on health-care workers, other than radiological technicians⁷.

In order to improve the implementation of IPC measures in the radiology departments of all the

government and private hospitals in Sudan, there is a need to establish a central regulating body and promote IPC training programs to create more awareness among the concerned individuals. The attitude of the radiology staff in Sudan towards this matter is quite encouraging. Still, more fruitful results can be achieved by taking the WHO online training programs regarding infection prevention and management of COVID-19 patients. The infection control experience of the department staff could play an important role in the prevention of infection. Many surfaces and equipment in the radiology departments can present great challenges for effective disinfection⁸. Disinfection practices are effective in reducing or eliminating pathogens. Radiology workers should be aware of the value of disinfecting contact surfaces between patients, to prevent infection transmission⁹.

This study clearly found that the work experience in years was significantly related to the cleaning and decontamination of equipment and surfaces in the department. In a similar study, the more experience a radiology staff had, the better knowledge they have regarding infection prevention¹⁰. Multiple sources of information, teaching, and training medical students are available. The evidence for the most appropriate method of teaching and learning for medical students has been conflicting. The effect of the variety of teaching types reported by students, in various studies, was unclear¹¹. A study in the People's Republic of China had clearly demonstrated that a one-time intervention program had no effect on knowledge⁸. A United Kingdom (UK) study demonstrated that structured teaching programs are effective^{12,13}. Furthermore, a single infection control educational intervention provided in medical schools is inadequate to teach students about infection control and safety techniques¹⁴.

This study was limited as it did not investigate which resources were inadequate and therefore is recommended that Sudan conduct a contextual analysis regarding the reasons for infection control principles not being adhered to and which resources are required to successfully implement infection control in government hospitals. Further, it is recommended that an infection control policy or national guideline should be implemented in radiology departments in Sudan, that could assist with the implementation of infection control. This was also recommended in a systematic review regarding HAIs in Africa¹¹. There is a need for further exploration of the reasons for the significant relationship between age and knowledge, as well as radiographers' attitude towards infection control, which was not investigated in this study. Although this study was done to validate the questionnaire, questions and instructions could

have been misunderstood. Further, the questionnaire could have influenced the results, as it was positively leading due to all answers for correct adherence being 'always' and this could be viewed as a limitation to this study. Further adjustment and testing of the questionnaire is therefore recommended. Furthermore, as the small sample size was a limitation to this study and this study was the first of its kind, the research should be repeated in radiology departments in all government hospitals in Sudan.

CONCLUSIONS

The response and attitude of staff within radiology departments in Sudan regarding COVID-19 infection prevention and control, knowledge and awareness is quite encouraging, also the knowledge regarding standard IPC measures is quite reasonable, as indicated by our results.

Authors Contributions

Conceived, designed, conduct statistical analysis and editing of manuscript, A. E.; data collection and manuscript writing, M. Z. and M. M.; overall supervision, revision, final drafting and approving, A. E. and B. A. Project administration, M. M. All the authors have read and agreed with the final version of the article.

Compliance with Ethics Requirements:

„The authors declare no conflict of interest regarding this article“

„The authors declare that all the procedures and experiments of this study respect the ethical standards in the Helsinki Declaration of 1975, as revised in 2008(5), as well as the national law. Informed consent was obtained from all the patients included in the study“

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