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# Evaluating Factors Affecting Clinicians' Knowledge on Contrast Media: Kenyan Experience

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## Abstract

**Purpose:** Our study aimed to establish exposure to and level of knowledge about contrast media among non-radiological clinicians and evaluate the contributory factors to the status.

**Methods and Materials:** A cross-sectional study was conducted between April and December 2015 through interviews using structured questionnaires. We recruited 197 non-radiological clinicians with experience in use of contrast media in their routine practice. They were of different cadres and years of experience, all working in a large referral hospital in Kenya. Levels of basic knowledge on contrast media were evaluated through a scoring system after each clinician responded to the questions provided. We also sought for training on contrast media among these clinicians and where applicable the source of the same recorded. Descriptive and inferential statistical methods were applied across the different clinicians' subsets.

**Results:** Thirty-seven respondents representing 18.8% of the study sample had received formal training on contrast media. Mean knowledge score for all clinicians in this study was 14.6 translating to 14.1% of a set maximal theoretical score of 103 points. The standard deviation was 5.5. Analysis of variance (ANOVA) test for knowledge mean score among different cadres gave a P value 0.079. Unpaired t-test gave a two- tailed P value 0.2410 for mean score when trained and untrained clinicians were compared. The level of knowledge (mean score) when analysed against years of experience for the clinicians produced statistically significant results with P value 0.001084.

**Conclusion:** Training and knowledge on contrast media can be profoundly low for clinicians. However, there is a possibility of knowledge improving from experience in practice due to multidisciplinary interaction and the implied advantage of encapsulated knowledge.

## Introduction

CONTRAST media are agents that enhance the difference in appearance between structures and fluids within the body for better anatomical depiction and improved diagnostic image quality. These agents are utilized largely in radiology and as such are among the most prescribed drug groups worldwide. In a 2005 publication, Christiansen stated that about 75 million doses of iodinated contrast agents were administered to patients annually worldwide (1). In an initial primary survey conducted at Kenyatta National Hospital in Kenya, it was determined that 5,268 radiological investigations were performed with contrast media between January and June in 2014. Together these studies impressively required 740 liters of contrast media. Of note, clinicians outside of the radiology department requested the majority of these studies.

There are known adverse reactions reported in less than 1% to over 12% of patients that undergo contrast media

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administration. Most complications are mild in severity and result from intravenous administration of contrast media. Mild manifestations typically include allergic-like reactions, nausea and vomiting, while the severe reactions can be life threatening, such as angioneurotic edema (2-10).

Acute renal injury is typically a reversible adverse reaction in healthy individuals; however, the condition can have much more serious consequences in patients that have existing co-morbidities. This injury may be more common than previously thought as recent studies cite incidences of up to 14% (11).

To date, no study has assessed the level of knowledge about contrast media among non-radiological clinicians in Kenya. This information is important as non-radiological clinicians order the majority of contrast-enhanced studies and the administration of contrast is not without risks for patients.

Here, we report findings from a cross-sectional study to elucidate non-radiological clinician understanding of contrast media and potential adverse outcomes of contrast administration. Our study highlights the need for on-going education about contrast use and provides valuable information to improve current practices in Kenya. We also evaluated the contributory factors to the status.

## Materials and methods

Following approval by the local ethical review committee, a cross-sectional study was carried out within a large national referral and teaching hospital in Kenya between April 2015 and December 2015. 197 non-radiology clinicians were recruited spanning different cadres, namely non-graduate, graduate and post-graduate levels of training. These are locally known as clinical officers, medical officers or house officers and consultants, respectively. The clinicians were from various specialties, such as general medicine, internal medicine, surgery, paediatrics, gynaecology and others. Only clinicians who had experience in ordering contrast studies in their routine clinical practice were included in this study. Those who fit the inclusion criteria but were unwilling to participate upon request for consent were excluded from the study.

A structured questionnaire was presented for face-to-face interview with the participating clinicians following successful pre-test with radiology residents.

Variables included the general demographics, cadre and years of experience since qualification.

Subject matter presented in the interview included: knowledge on contrast media definition, applications, routes of administration, adverse reactions manifestations, risk factors as well as their management and prevention. The responses by each clinician were scored against a detailed reference document with theoretical maximal score of 103 points. Exposure to knowledge on contrast media through formal training in medical school curriculum or continuous medical education (CME) sessions was elicited in the questionnaire.

The data were captured using MS-Excel® and SPSS® software and subsequently descriptive and inferential statistical analysis performed.

## Results

The respondents included 18 non-graduate (clinical officers), 157 graduate (medical officers or house officers) and 22 post-graduate (consultant) clinicians. The age range was 24 to 57 years with 117 male and 80 female respondents. Practice experience was from less than 1 to 31 years after their qualification.

Only thirty-seven respondents representing 18.8% of the study sample had received formal training on contrast media. Medical curriculum and CME training were recorded in 26 (13.2%) and 11(5.6%) of the respondents, respectively. Out of this group, only six had both types of training.

The mean knowledge score for all clinicians in this study was 14.6 translating to 14.1% of the maximal theoretical score of 103 points. The standard deviation was 5.5. Stratified mean knowledge scores and standard deviations according to the cadres are demonstrated in Table 1. Analysis of variance (ANOVA) from this stratified data gave a P value of 0.079 (statistical significance was determine to be $P< 0.05$).

**Table 1.** Stratified mean scores and standard deviations for the different cadres.

| | Non-graduate | Graduate | Post-graduate | Total |
|---|---|---|---|---|
| *N* | 18 | 157 | 22 | 197 |
| $\sum X$ | 287 | 2227 | 366 | 2880 |
| *Mean* | 15.9444 | 14.1847 | 16.6364 | 14.6193 |
| $\sum X^2$ | 5293 | 36371 | 6270 | 47934 |
| *Std. Dev.* | 6.4941 | 5.5364 | 2.9366 | 5.4541 |

In regard to the trained and non-trained clinicians, the mean scores were 15.87 and 14.54, respectively, with corresponding standard deviations of 7.05 and 5.56. Unpaired t-test gave a two-tailed P-value of 0.2410, which is not statistically significant. Mean scores among the clinicians who had undergone curricular, CME or both types of training were 14.8, 16.8 and 19.2, respectively. The ANOVA result gave a P value 0.43, which is not statistically significant.

When analyzed against years of experience, the mean scores were statistically significant ($P= 0.001084$ by ANOVA [Table 2]). Tukey HSD test component of the ANOVA specified significant differences between group 1 (less than 2 years) vs group 4 (over 10 years) and group 2 (between 2 and 5 years) vs group 4. No significant differences were found between any other group combinations.

Further analysis of the specific groups within the stratification according to the years of experience and training on contrast media is outlined in Table 3.

**Table 2.** Stratified mean scores according to years of experience.

| | Less than 2 years | 2-5 years | 5-10 years | Over 10 years | Total experience |
|---|---|---|---|---|---|
| *N* | 13 | 44 | 110 | 30 | 197 |
| *X* | 174 | 566 | 1605 | 535 | 2880 |
| *-Mean* | 13.3846 | 12.8636 | 14.5909 | 17.8333 | 14.6193 |
| $X^2$ | 2472 | 8178 | 27167 | 10117 | 47934 |
| *Variance* | 11.9231 | 20.8647 | 34.3907 | 19.8678 | 29.7472 |
| *Std. Dev.* | 3.453 | 4.5678 | 5.8644 | 4.4573 | 5.4541 |
| *Std. Err.* | 0.9577 | 0.6886 | 0.5591 | 0.8138 | 0.3886 |

**Table 3.** Proportion of trained clinicians in each categorized years of experience.

| | Less than 2 years | 2 to 5 years | 5 to 10 years | Over 10 years | Total |
|---|---|---|---|---|---|
| *Training* | 0 (0.00) | 10 (0.23) | 21 (0.19) | 6 (0.20) | 37 (0.19) |
| *No training* | 13 (1.00) | 34 (0.77) | 89 (0.81) | 24 (0.80) | 160 (0.81) |
| *Total* | 13 (1.00) | 44 (1.00) | 110 (1.00) | 30 (1.00) | 197 (1.00) |

## Discussion

Extensive knowledge on contrast media is mandatory for the radiology practitioner; however, adequate basic operating knowledge is also required for non-radiology clinicians. One example of the urgency of recognizing adverse reactions is potential for anaphylaxis. In addition to initiating a life-saving intervention, clinicians that recognize anaphylactic reactions from contrast media may be more likely to diagnose hypersensitivity syndromes. This can play a role in counseling about necessary precautions since similar pathways can be found in cases of other anaphylaxes (12,13).

The mean scores from this study indicate a lack of knowledge regarding contrast agents as well as adverse reaction risk among clinicians in Kenya. Lack of statistical difference in levels of knowledge between the formally trained and the untrained clinicians is surprising. It is possible this is an attitude issue. On assessing and defining knowledge in medical practice, Michael Eraut gives three spheres of approach, namely codified, cultural and personal components (14). The findings in our study bring forth the prominence of cultural and personal knowledge gained from practice experience rather than formal training. Of note, most participants lacked access to codified knowledge (i.e. that expected to be imparted through formal medical curricular or CME sessions). Probably, a higher cultural knowledge threshold could have been attained altering the results had we been dealing with a more trained sample.

There is also the principle of encapsulated knowledge that has been documented to have influence in medical practice from various studies and publications. Rikers et al. advocate for introduction of concepts early in the curriculum to support the process (15). Unfortunately, none of the early career clinicians (less than two years' experience) in our study had any formal training on contrast media. In Kenya, doctors with less than two years' experience are not admitted for postgraduate training. Hence, they are basically operating on knowledge learnt during their medical school training and any CME session they might have received. This presents an evident training needs gap.

In response to these findings of the lack of training and limited clinician knowledge, there is much that can be done to improve these deficits. Multidisciplinary interaction among clinicians is an inherent part of experience in medical practice. Especially in a teaching hospital, this cannot be underrated in its role to impart knowledge (16). The day-to-day informal interactions among clinicians when managing a patient qualify for CME in their own right and must not be overlooked (17). Providing informal teaching during routine daily interactions can significantly increase knowledge of contrast media and adverse reactions. In addition, radiologists and clinicians communicate daily via the radiological request document. This is a powerful educational tool (18) that must be designed and utilized optimally. In fact, several radiology professional organizations have published contrast media guidelines for both clinicians and radiologists (19, 20, 21). Yet, in most developing countries, including Kenya, such tools are non-existent and this can contribute to low awareness among clinicians. Adaptation of existing materials and implementation into practice are of utmost importance.

A limitation of our study is that it was not designed to assess levels of knowledge pre- and post-CME intervention.

We also encourage researchers with interests in medical education to conduct more studies to assess the impact of curriculum and CME versus experience in the level of knowledge.

## Conclusion

Training and knowledge on contrast media can be profoundly low for clinicians in Kenya. This study demonstrates that there is a gap in knowledge among both trained and untrained clinicians regarding contrast media and adverse reactions to contrast administration. Education on contrast media and associated patient risks must be included in CME, curricular training and interdisciplinary tools of communication. Furthermore, we also identify several avenues of knowledge improvement, from experience in practice due to multidisciplinary interaction and the implied advantage of encapsulated knowledge.

## Supplemental content

Supplementary data for this article can be found at http://dx.doi.org/10.7191/jgr.2017.1030 under "Additional Files".

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## Conflict of interest

The authors report no conflict of interest.

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