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ORIGINAL ARTICLE

Quantitative Analyses of Diagnostic and Nondiagnostic Images in the Undergraduate Regional Anatomy Textbook

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ABSTRACT

Background*: Students may more effectively understand the spatial relationships and variations of anatomical structures by using diagnostic images that provide a realistic and three-dimensional view of the human body. It may be assumed that good Regional Anatomy textbooks reflect the essential aspects of the recent global trends in diagnostic image teaching, learning, and assessment. So, this research aimed to analyze the frequency of diagnostic images and nondiagnostic images in the commonly recommended Regional Anatomy textbook (Snell, 10th edition).* ***Methods & Materials:*** *This study is a descriptive study involving quantitative analysis of the diagnostic and nondiagnostic images and different 'forms' and 'types' of diagnostic and nondiagnostic images of the Regional Anatomy textbook.* ***Result:*** *11.13% of diagnostic images and 88.87% of nondiagnostic photos were identified.* ***Conclusion:*** *The present study has shown that a sufficient amount of nondiagnostic images and some diagnostic images are present in the Regional Anatomy textbook. The use of diagnostic images can enhance the structural conception of the medical undergraduate students.*

Keywords*: Regional Anatomy, Medical undergraduate student, Diagnostic image, Nondiagnostic image*

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INTRODUCTION

Medical imaging is an essential tool for the clinician, providing a view into the anatomical integrity of the patient. With the new imaging technologies in clinical practice, a detailed knowledge of anatomy becomes even more important. This offers students the ability to apply their basic anatomy knowledge to the interpretation of two-dimensional X-ray, sectional computed tomography (CT), and magnetic resonance imaging (MRI). Teaching anatomy to undergraduate medical students using imaging modalities, including radiographs, CT, MRI, and, more recently, ultrasonography, has been found to have many benefits, including improving performance[1].The nature of anatomy education has gradually changed mainly due to the introduction of new imaging techniques that support more traditional methods[2].As it offers visual confirmation during the learning process, the diagnostic image contributes to the understanding of gross anatomy[3].In this way, students gain immediate awareness of the clinical relevance of anatomical knowledge while also gaining familiarity with radiological findings[4].This resulted in the enrichment of the diagnostic image, such as X-ray, CT Scan, MRI, ultrasonography, isotope scan, and coronary angiogram, for enhancing the clinically qualified anatomists. Determination of the percentage frequencies of different 'types' of the diagnostic images in the Regional Anatomy textbook diagnostic images are not only an important pillar of diagnosis, treatment planning, and follow-ups, but with the growing field of computer-assisted surgery, more and more interventions are performed under image guidance. The General Medical Council's Tomorrow's Doctors initiative highlights the significance of anatomy in the medical curriculum today and urges medical institutions to use modern technology to enhance their teaching methods [4]. Alternative materials for anatomy dissections have included radiography from cadavers and ultrasound from living people [5].

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METHODS & MATERIALS

Collecting the Regional Anatomy textbook commonly recommended for the medical undergraduate course in Bangladesh (Snell, 10th edition) and counting the number of diagnostic images and nondiagnostic images in the textbook. Then, identifying the different 'types' and 'forms' of diagnostic (x-ray, MRI, CT scan, USG, and other diagnostic images) and nondiagnostic (realistic, semi-realistic, and schematic diagrams) images.

The diagnostic images of the selected textbook were classified into several 'types' on the basis of how they were created and what they look like. The diagnostic images were marked with different symbols according to their 'types'. Later, they were counted following the symbols. The X-ray, MRI, CT scan, USG images, and other diagnostic images were included as different 'types' of diagnostic images in this research. The other diagnostic images include a colonoscopy image, a laparoscopy image, an arthroscopy image, a bronchogram, a coronary angiogram, and an arteriogram. Then, the number of each 'type' of diagnostic image was counted and expressed as a percentage of all the diagnostic images used in the Regional Anatomy textbook, as well as all the compartments of that textbook.

The nondiagnostic images of the selected textbook were classified into several 'forms' on the basis of how they were created and what they look like. The nondiagnostic images were marked with different symbols according to their 'forms'. Later, they were counted following the symbols. The realistic, semi-realistic, schematic, and photographic nondiagnostic images were included as different 'forms' of nondiagnostic images in this research. Then, the number of each 'form' of diagnostic images was counted and expressed as a percentage of all the nondiagnostic images used in the Regional Anatomy textbook.

RESULTS

The number of diagnostic and nondiagnostic images analyzed (for their 'types' and 'forms') in the Regional Anatomy textbooks (Snell 10th edition) was as follows:

a. Diagnostic images: 61 images (11.13%)
b. Nondiagnostic images: 487 images (88.87%)

Table I shows that total number of 548 diagnostic images and nondiagnostic images were analyzed for their 'types' nondiagnostic images of the different 'types and 'form'. The results are determined by the mean percentage frequency of diagnostic images and nondiagnostic images.

Table – I: The mean percentage frequency of diagnostic images and nondiagnostic images of the medical undergraduate students' textbook of Regional Anatomy

Variable	Mean percentage frequency of diagnostic image ±SD	Mean percentage frequency of nondiagnostic image ±SD
Introduction	9.09 ± 3.34	90.91 ± 8.47
The thorax	14.29 ± 4.87	85.71 ± 7.43
The abdomen	8.96 ± 3.92	91.04 ± 8.21
The pelvis	7.69 ± 3.11	92.31 ± 8.19
The upper limb	9.52 ± 3.24	90. 48 ± 7.89
The lower limb	11.37 ± 4.26	88.63 ± 6.64

SD, Standard Deviation

Table II presents data indicate that X-ray imaging is the predominant diagnostic modality across most anatomical regions, particularly in the thorax (90.46%), lower limb (81.82%), and upper limb (70%). In the introduction, X-ray, MRI, and CT are equally represented (33.33% each). The abdomen and pelvis show a more varied distribution, with moderate use of MRI, CT, USG, and other modalities alongside X-rays. Overall, conventional radiography remains the primary imaging technique, while advanced modalities are used selectively depending on the region.

Table – II: Determination of the percentage frequency of different 'types' of diagnostic images of each compartment of the Regional Anatomy textbook

Variable	Percentage frequency of different 'types' of the diagnostic images				
	x-ray images (%)	MRI (%)	CT scan images (%)	USG images (%)	Other diagnostic images (%)
Introduction	33.33	33.33	33.33	0.00	0.00
The thorax	90.46	2.25	4.75	0.00	2.54
The abdomen	38.46	7.69	7.69	15.38	30.76
The pelvis	57.14	14.28	14.28	14.28	0.0
The upper limb	70.00	10.00	10.00	0.00	10.00
The lower limb	81.82	9.09	0.00	0.00	0.00

Table III presents that schematic image constitute the highest proportion of nondiagnostic images across all sections, ranging from 58.76% (upper limb) to 72.41% (thorax). Semi-realistic images are the second most common, varying between 11.21% (thorax) and 53.33% (introduction). Realistic images remain low overall (2.85%–10.00%), while photographs account for the smallest share in most sections (1.03%–5.71%). Overall, schematic and semi-realistic images together comprise more than 80% of nondiagnostic images in most anatomical regions, indicating a strong preference for simplified visual representations.

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Table – III: Determination of the percentage frequency of different 'forms' of the nondiagnostic images of each compartment of the Regional Anatomy textbook

Variable	percentage frequency of different 'forms' of the nondiagnostic images			
	Realistic images (%)	Semi-realistic image (%)	Schematic images (%)	Photographs (%)
Introduction	10.00	53.33	33.33	3.34
The thorax	5.17	11.21	72.41	2.50
The abdomen	8.73	15.87	69.84	5.55
The pelvis	4.17	20.83	70.83	4.1
The upper limb	6.18	24.74	58.76	1.03
The lower limb	2.85	31.43	60.00	5.71

DISCUSSION

The present research was designed to identify diagnostic images and nondiagnostic images in the recommended Regional Anatomy textbook for medical undergraduate students of Bangladesh, to address the understanding of medical undergraduate students of addressing the issue at the beginning of the course (first phase) during teaching-learning regional anatomy might help medical undergraduate students understand the anatomical structure of the living human body through realistic visualization. different 'forms' of diagnostic images in the Regional Anatomy textbook.

The analyses of diagnostic images and nondiagnostic images of the medical undergraduate students' textbook of Regional Anatomy revealed that the mean percentage frequency of the diagnostic images was 11.13% and the mean percentage frequency of nondiagnostic images was 88.87%. The percentage frequency of different 'types' of diagnostic images and different 'forms' of nondiagnostic images of the Regional Anatomy textbook was also analyzed. The highest frequency of 'type' of the diagnostic images was x-ray images, which were 65.57% and the lowest frequency of 'type' of the diagnostic images was USG images, which were 6.55%. The highest frequency of 'form' of the nondiagnostic images was schematic images, which were 65.29% and the lowest frequency of 'form' of the nondiagnostic images was photographs, which were 5.54%. The findings of the analyses of the diagnostic image and nondiagnostic image suggest that greater emphasis should be placed on the teaching-learning process, not only by the nondiagnostic images, but also by giving significant importance to different 'types' of diagnostic images.

A similar study was done at BSMMU by Amin [6] in which different forms of histology illustrations were analyzed. She found that the most frequent of the illustrations belong to the 'form' 'schematic and three-dimensional diagram' (32.14%) in Junqueira and Carneiro (2006) and to 'photomicrograph-routine stain– high power' (29.90%) in Ross and Pawlina (2006). 'Photomicrograph-special stain`s/special fixatives' (27.69%) has the next greatest value in Junqueira and Carneiro (2006), and 'schematic and three-dimensional diagram' (28.09%) in Ross and Pawlina (2006). The mean proportion of area occupied by 'electron micrograph' in two textbooks is about 17.48%, whereas the mean proportion of 'photomicrograph- routine stain- low power' is only 7%.

The advancement of technology has allowed anatomical images to take on new dimensions. Three-dimensional (3D) diagnostic images are extremely beneficial in teaching structural anatomical knowledge, raising student interest, making learning simple, and teaching challenging subjects. Numerous studies have demonstrated the effectiveness of the diagnostic images in teaching anatomy and efficiency because they require less time than the traditional way to deliver the knowledge [7]. Medical students' attitudes toward diagnostic images and their thinking about the field might also be influenced by Preclinical exposure to imaging. Given these factors, it would appear that any teaching strategy that enhances student awareness of anatomy's clinical significance and places anatomy in a clinical context will enhance their understanding of relevant anatomical ideas [2]. Diagnostic images are not only an important pillar of diagnosis, treatment planning, and follow-ups, but with the growing field of computer-assisted surgery, more and more interventions are performed under image guidance. The General Medical Council's Tomorrow's Doctors initiative highlights the significance of anatomy in the medical curriculum today and urges medical institutions to use modern technology to enhance their teaching methods [4]. Alternative materials for anatomy dissections have included radiography from cadavers and ultrasound from living people [5].

Recently the teaching-learning concept and the assessment system of Regional Anatomy have changed. In recent textbooks, the importance of diagnostic images and clinical aspects has increased both in respect to quality and quantity [8]. The different domains of competence can be assessed in an integrated, coherent, and longitudinal fashion with the use of multiple methods and provision of constructive feedback [9].

There is a widespread consensus worldwide that Anatomy education needs to be structured so that students can apply it in practical situations and that it corresponds to the skills required of future medical graduates [3]. The students, practitioners, and patients are interdependent on each other, and the Anatomy makes a bond between them. Many anatomists and other clinicians strongly believe that anatomy must be taught and learnt within a context that is clinically meaningful and related to the competencies required by new medical graduates, so that students understand its relevance to their future practice [3].

CONCLUSION

The present study has shown that the sufficient amount of nondiagnostic images and some numbers of diagnostic images are present in the Regional Anatomy textbook. It may be concluded that, to learn and understand Regional Anatomy, it is necessary to address and approach combination strategy using diagnostic images beside nondiagnostic images by the teachers. The use of diagnostic image can enhance the clinical skill of the medical undergraduate students with proper conception of internal structures of the human body compared to nondiagnostic images.

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