RUTGERS
New Jersey Medical School

Assessing the value of standardized radiology teaching modules on education of rotating medical students

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Goals

- *To create and present a standardized curriculum for medical students on the radiology rotation consisting of teaching modules on fundamental topics in radiology.*

- *To assess the effectiveness the standardized curriculum on medical students' understanding of fundamental radiology principles through the use of quizzes before and after the rotation.*

Background

The radiology elective is a popular clinical elective for third and fourth year medical students at our institution for both radiology-bound students and those intending to pursue training in other specialties.

The topics and scope of didactic student education on our clinical elective have traditionally been at the discretion of the residents and attendings on service, without formal assessment of content retention.

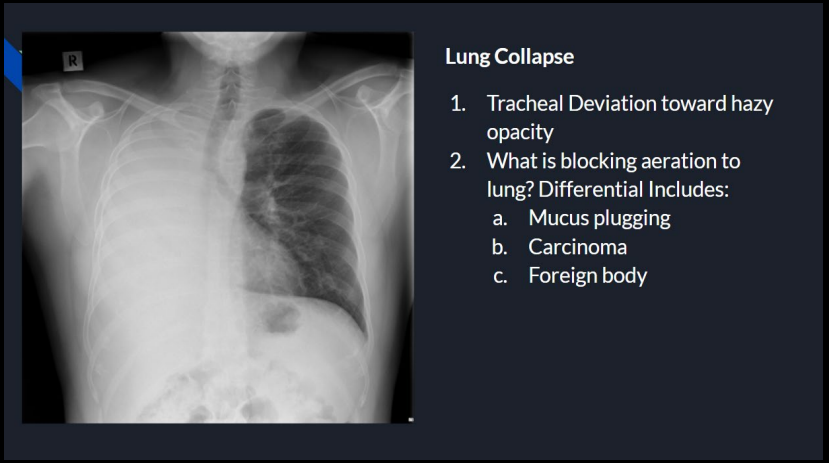
In order to ensure a comprehensive educational experience, we created a standardized series of didactic conferences administered by residents in our program. A brief multiple choice quiz was given to the students before and after the course to assess learning and retention.

Disclosure Statement: Authors have nothing to disclose.

Methods

- Six teaching modules on fundamental radiology topics in thoracic, gastrointestinal, genitourinary, ultrasound, musculoskeletal, and neuroradiologic imaging were created and presented to the rotating 3rd and 4th year medical students in sessions moderated by radiology residents.
- Quizzes consisting of 10 questions testing fundamental radiology concepts was given to the students before and after the didactic series.
- Quiz results were analyzed with descriptive statistics including mean, standard deviation, confidence intervals and a paired sample T-test to evaluate for statistical significance.

Lecture 1 - Thoracic Radiology



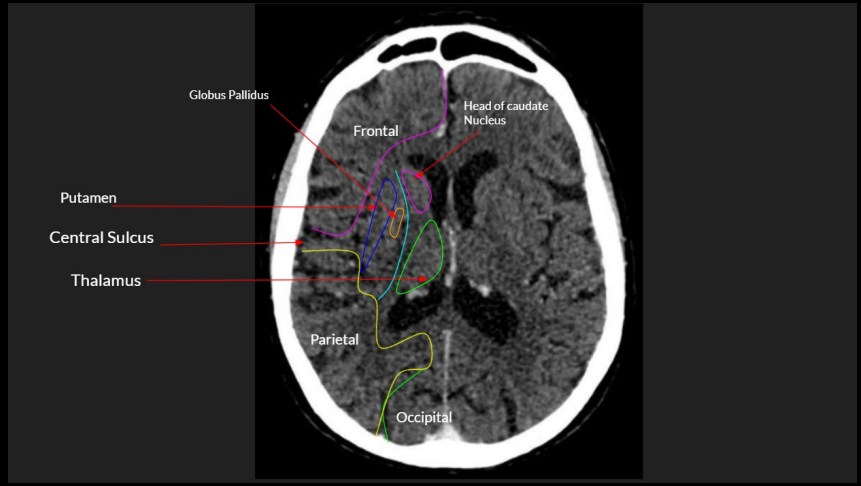
Lung Collapse

1. Tracheal Deviation toward hazy opacity
2. What is blocking aeration to lung? Differential Includes:
   a. Mucus plugging
   b. Carcinoma
   c. Foreign body

To demonstrate and evaluate:

- Anatomy of the thorax and suggest a search pattern based approach to chest radiography.
- Findings regarding the following etiologies were discussed:
  - Pulmonary vascular congestion and Pulmonary edema
  - Pleural effusion
  - Pneumonia
  - Atelectasis
  - ARDS
  - Pneumothorax
- Appearances of devices and lines - enteric tubes, cardiac defibrillators, endotracheal tubes

Lecture 2 - Neuroradiology



To demonstrate and evaluate:

- Anatomy and key landmarks of the cerebrum, ventricles, and basal cisterns
- Intracranial hemorrhages (Subarachnoid, Epidural, Subdural) and most common etiologies
- Strokes
- Hydrocephalus

Lecture 3 - Gastrointestinal Radiology

Biliary Colic + Gallstones

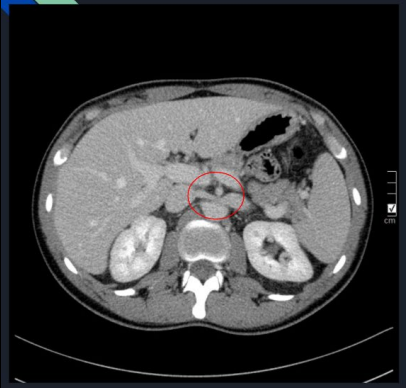
- **Gallstone** - Concretion in the gallbladder, cystic duct, or bile duct composed of cholesterol crystals
  - Hepatopancreatic Ampulla - Narrowest part of the biliary passages and is the common site for impaction of gallstones
  - Gallstone may also lodge in the hepatic and cystic ducts
- **Biliary Colic** - Intense, spasmodic pain when stone lodged in cystic duct
  - *Cystitis* - Inflammation of the gallbladder due to blockage
    - Pain is felt in the posterior thoracic wall or right shoulder due to irritation of the diaphragm

To demonstrate and evaluate:

- Anatomy of the liver and findings regarding portal hypertension, varicose veins, and portosystemic shunts
- Anatomy of the Gallbladder and findings regarding cholithiasis, acute cholecystitis, and cholecystoenteric fistula
- Anatomy of the pancreas, its anatomical relationships, and findings regarding pancreatitis, pancreatic cancer
- Anatomy of the abdominal vasculature

Lecture 4 - Genitourinary Radiology

Nutcracker syndrome



Renal Vein Entrapment Syndrome/ Nutcracker Syndrome

Remember → Longer left renal vein must traverse an acute angle b/w the SMA anteriorly and the abdominal aorta posteriorly

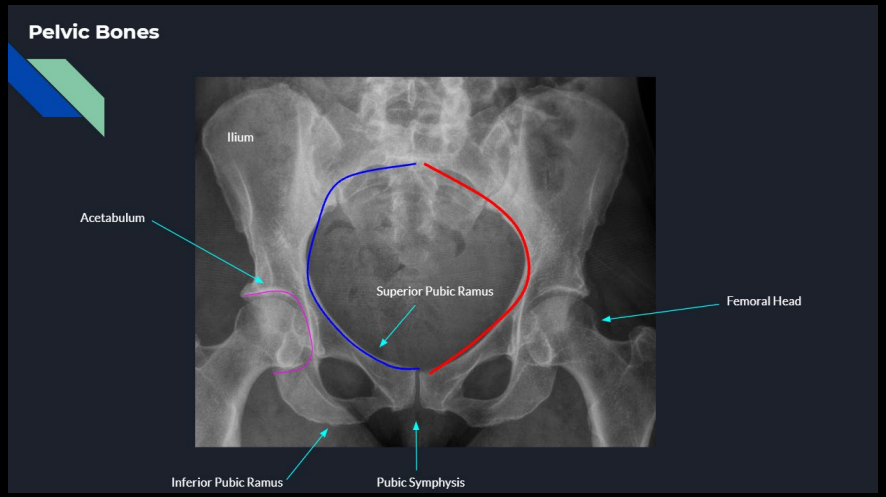
Downward traction on the SMA may compress the left renal vein → Renal Vein entrapment syndrome

Case credit to Radiopaedia

To demonstrate and evaluate:

- Anatomy of the kidneys and findings regarding pyelonephritis, renal infarcts, nephrolithiasis, and horseshoe kidney
- Anatomy of the renal vasculature and findings regarding nutcracker syndrome and renal transplants.
- Anatomy of the adrenal glands and findings regarding adrenal hyperplasia and pheochromocytoma
- Anatomy of the ureters
- Anatomy of the bladder and findings regarding bladder rupture

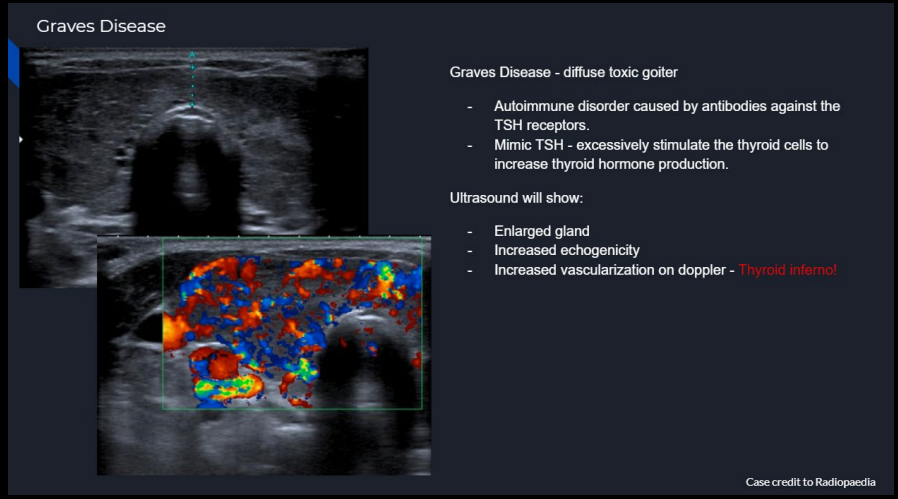
Lecture 5 - Musculoskeletal Radiology



To demonstrate and evaluate:

- The anatomy of the shoulder and findings regarding shoulder dislocations
- Anatomy of the humerus and humeral fractures
- Shoulder calcific tendonitis
- Anatomy of the elbow and associated injuries
- Anatomy of the wrist and associated injuries
- Anatomy of the pelvis and hips and associated injuries
- Anatomy of the ankle with associated injuries

Lecture 6 - Ultrasound

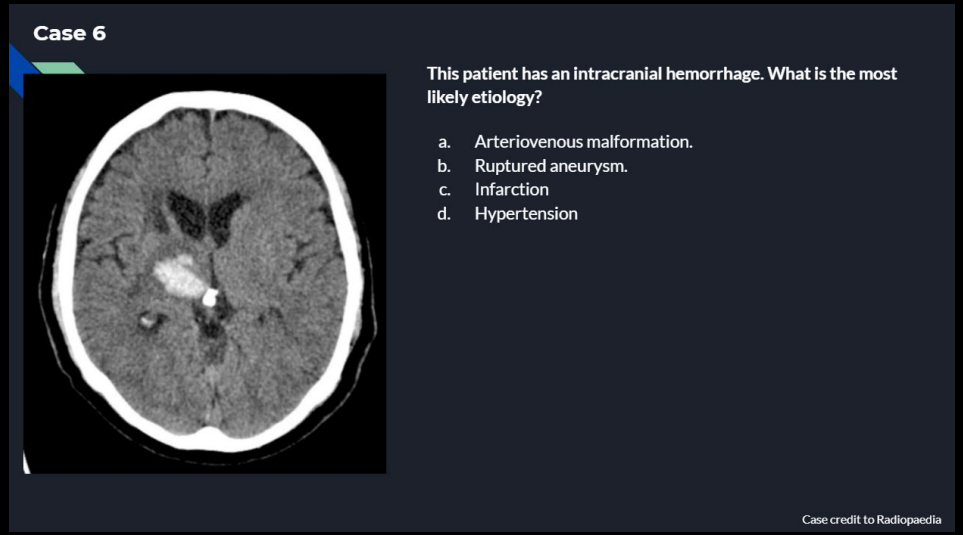


To demonstrate and evaluate ultrasonographic findings of:

- Hepatic Steatosis, Cirrhosis, Hepatocellular Carcinoma
- Acute Cholecystitis
- Nephrolithiasis
- Pyelonephritis, renal abscess, and end-stage renal disease
- Thyroid Nodules and TIRADS
- Graves Disease
- Varicocele & Hydrocele
- Testicular Torsion

Pre & Post Lecture Series Quiz

- A ten-question quiz was given before and after the didactic series to assess understanding and retention of knowledge.
- Topics include:
  - Cirrhosis and portal hypertension
  - Cholelithiasis
  - Hydronephrosis
  - Nephrolithiasis
  - Acute Stroke
  - Intracranial Hemorrhage
  - Pneumonia and pneumothorax



Results

Average Quiz Scores	Pre-Test (%)	Post-Test (%)	Standard Deviation	P-Value
All Students	65.3	79.4	12.0	0.0001
MS3 (n = 6)	61.7	80.0	8.9	0.01
MS4 (n = 11)	67.3	79.1	13.8	0.003

Average Score Improvement	Mean Improvement (%)	Standard Deviation	95% Confidence Interval
All Students	14.1	10.6	[8.6, 19.6]

Table 1. Average quiz scores of rotating third- and fourth-year medical students before and after instruction with a fundamental radiology lecture series

Results

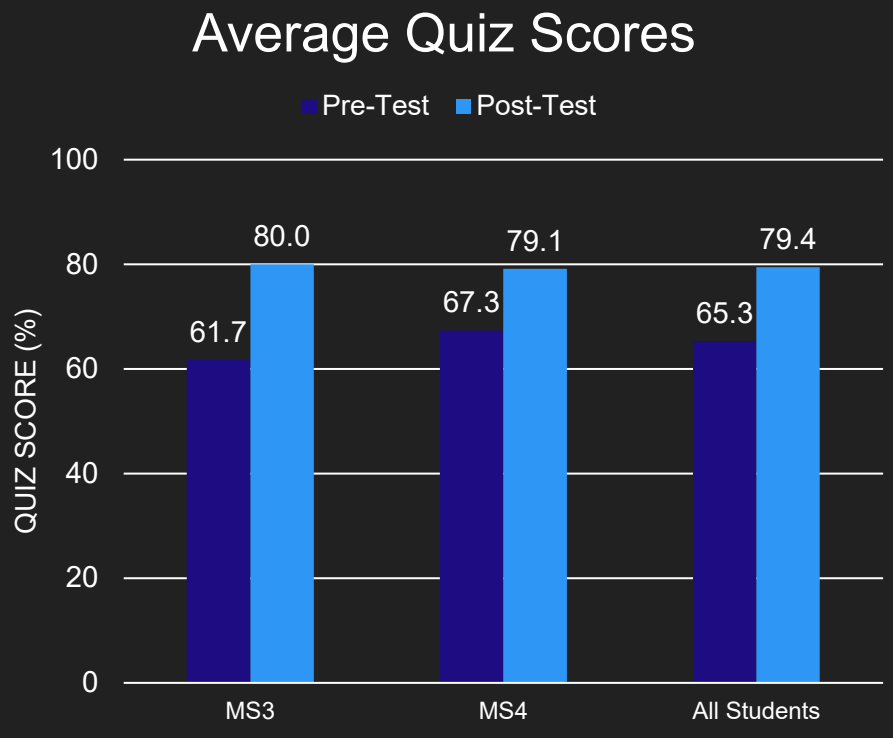


Figure 1. Both MS3 and MS4 students significantly improved their quiz scores after instruction with a fundamental radiology lecture series (p = 0.0001 for the total population).

- Average quiz scores among the rotating third-year (n=6) and fourth-year medical students (n=11) significantly increased after instruction with teaching modules, as per the results of a paired sample T-test.
- Third-year medical students scored an average of 61.7% prior to the didactic series and 80.0% afterwards (P = 0.01).
- Fourth-year medical students scored 67.3% before and 79.1% after the series (P = 0.003).
- Average improvement among the total population of medical students was 14.1%, 95% CI [8.6, 19.6].

Discussion and Conclusion

- A standardized focused set of teaching modules was effective at improving medical student comprehension of fundamental radiology principles.

- Educating medical students about radiology is crucial so that as physicians they can appropriately order radiology tests and understand the results to more effectively manage their patients.

- For further development we plan on refinement of the lectures to cover a greater breadth of concepts with additional and more robust quizzes to better assess the efficacy of the teaching modules.

Thank you!

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