



Practice Changes as Technology Advances

Examples in Trauma and Acute Care Surgery

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Outline

- 1 What is Trauma and acute care surgery?
- 2 How Practice changes as technology advances
- 3 Application of the deep learning in Trauma images

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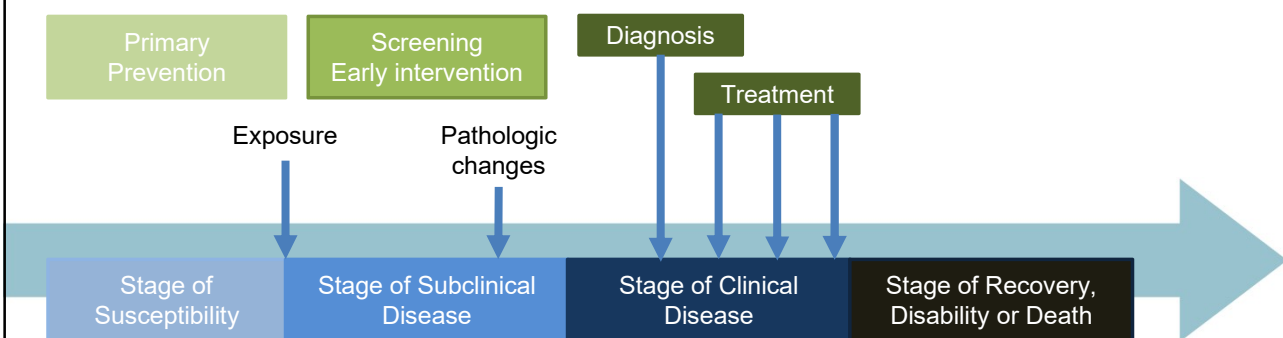
General surgery & Trauma care



-  Stomach and intestine
-  Liver, pancreas, biliary system
-  Breast
-  Thyroid
-  Trauma & acute abdomen
Intensive care

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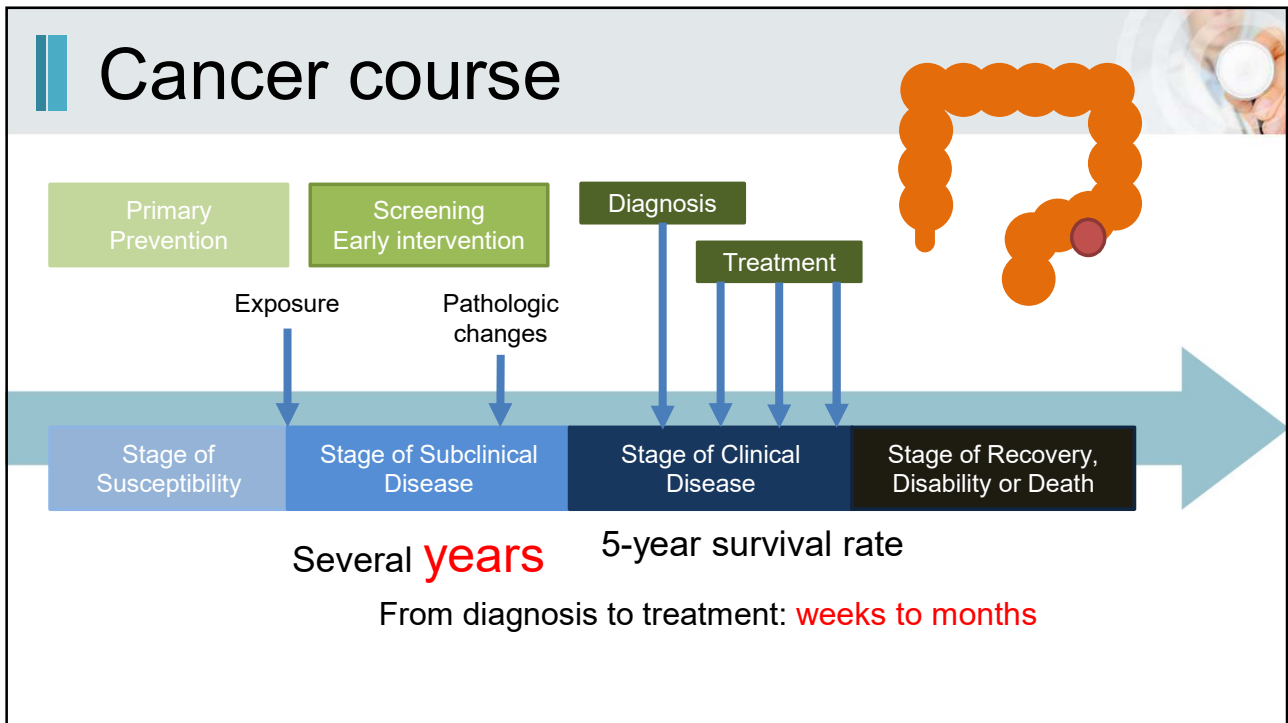
Disease course



What's your expectation for the doctor's diagnosis?
What's your expectation for the doctor's treatment?

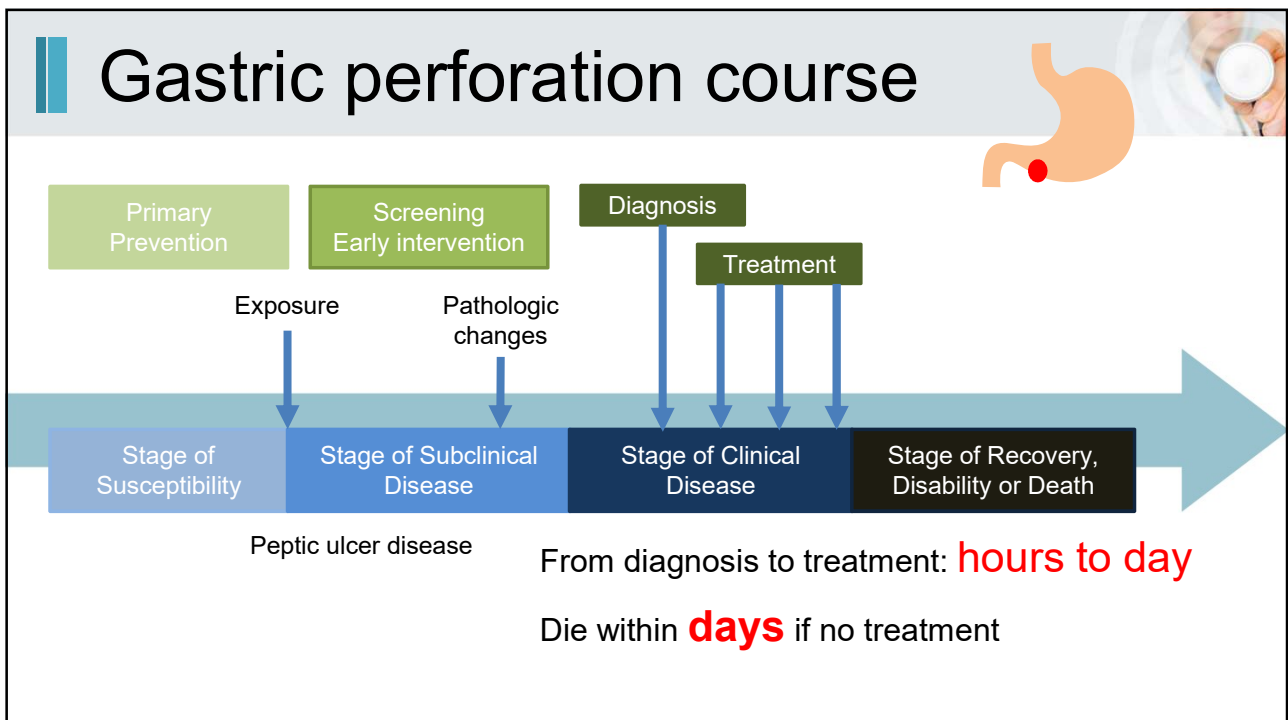
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Cancer course



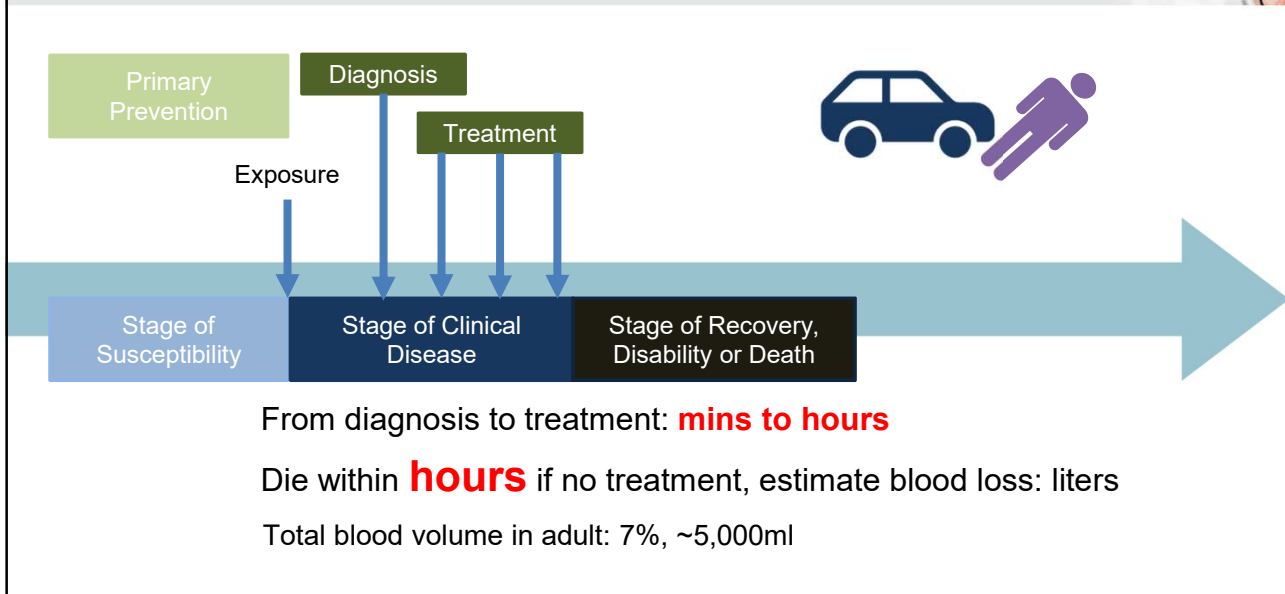
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Gastric perforation course



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Trauma with spleen injury course



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How medical practice change?



Medical inventions

Preclinical studies

Clinical trials

Market release

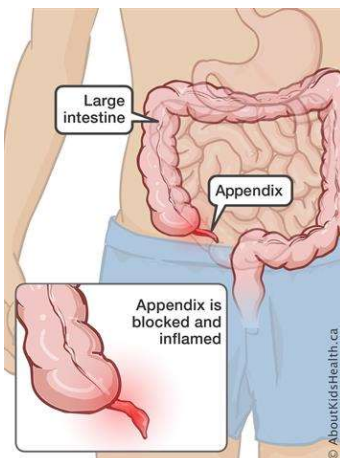
Integrate into **clinical workflow**

Evaluation (many studies)

Paradigm shift

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Acute appendicitis



The lifetime risk of appendicitis is 8.6% for males and 6.7% for females.

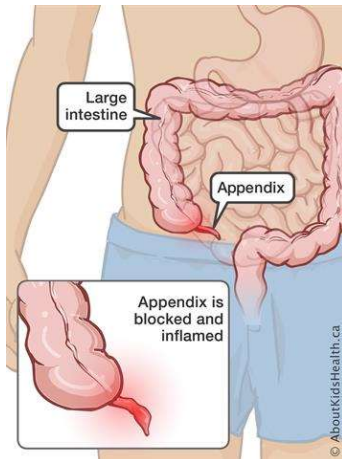
Typical initial symptom: epigastric pain, shift to right lower quadrant, diffused abdominal pain if perforated

Treatment: Appendectomy

Image source: <https://www.aboutkidshealth.ca/appendicitis>

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Acute appendicitis



1848, First abdominal surgery for appendicitis

1894, McBurney incision

1980, Kurt Semm performed the first laparoscopic appendectomy

Image source: <https://www.aboutkidshealth.ca/appendicitis>

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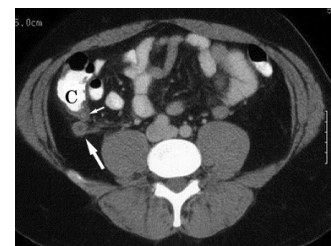
Diagnosis point of view

History taking and physical exam

“15% negative appendectomies”

Alvarado score in 1986, sensitivity: 72%

Computed tomography, sensitivity: 95%, Specificity: 96%

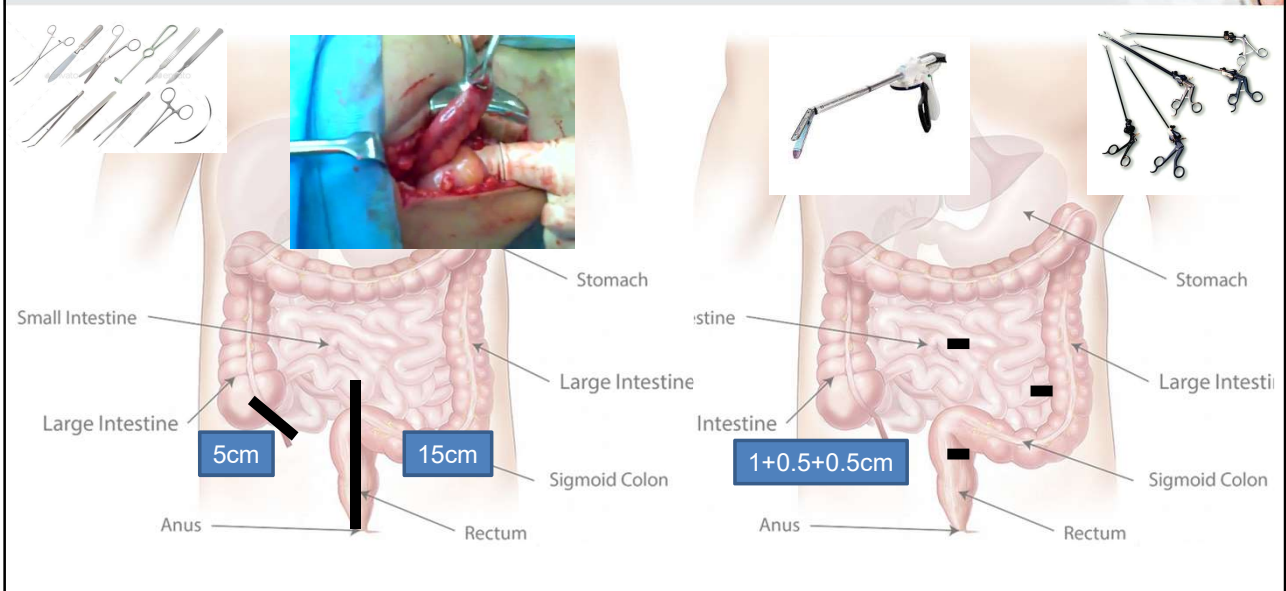


Pros and cons, What is your choice?

What's people's selection in 1990?

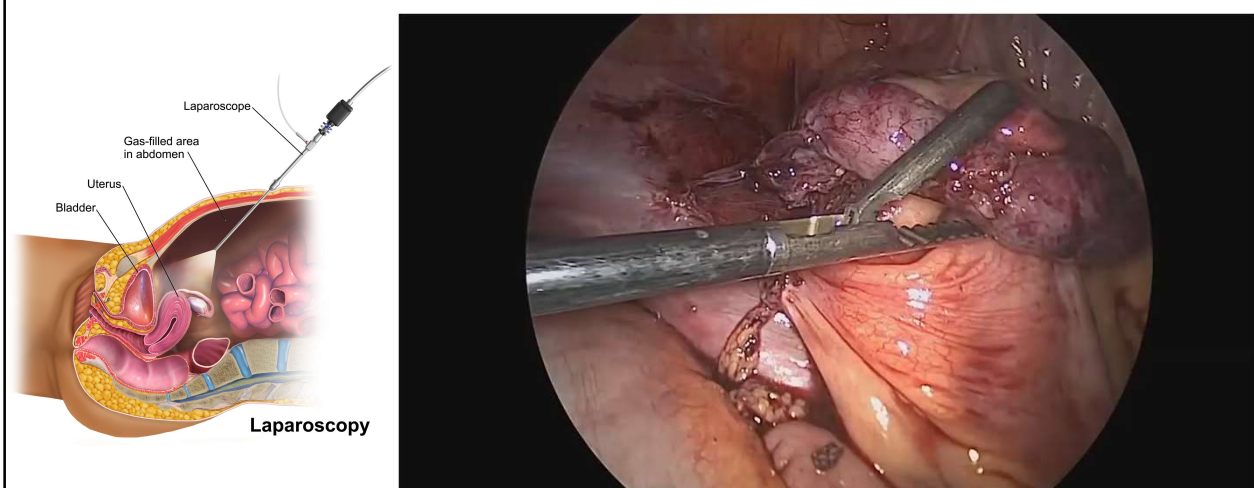
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Appendectomy: Open vs Laparoscopic



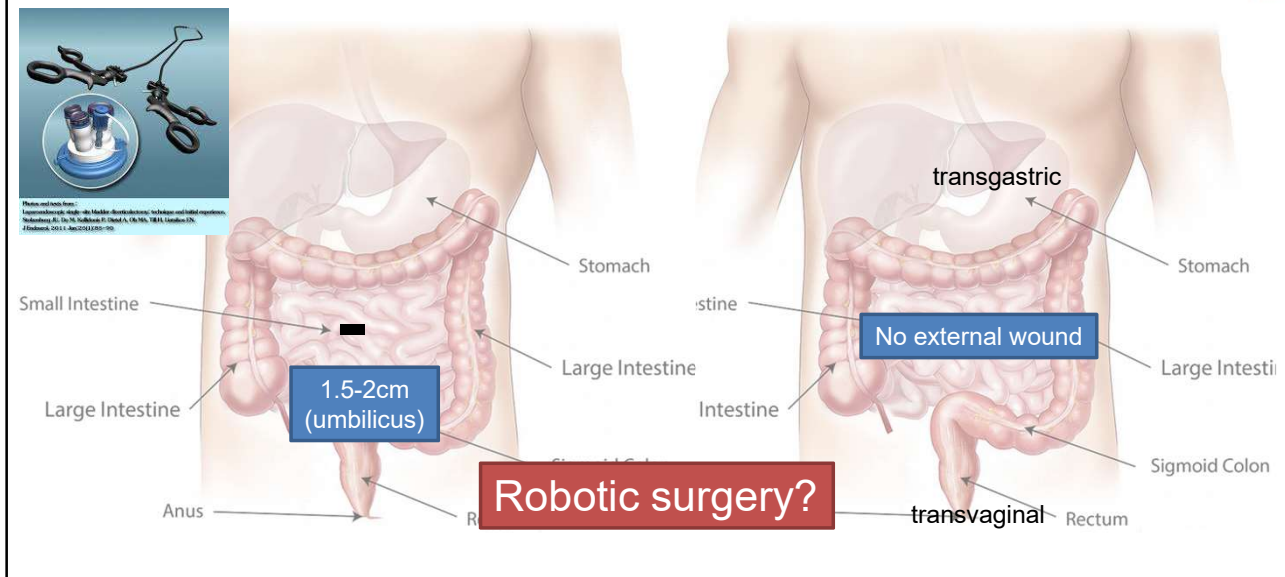
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Appendectomy: Open vs Laparoscopic



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Appendectomy: Single port vs NOTES



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Appendectomy: Open vs Laparoscopic

The laparoscopic approach was superior for:

- A lower rate of wound infections (OR 0.3 to 0.52)
- Less pain on postoperative day 1 (\downarrow 0.7 to 0.8/10-point)
- Shorter duration of hospital stay (\downarrow 0.16 to 1.13 days)

Harm?

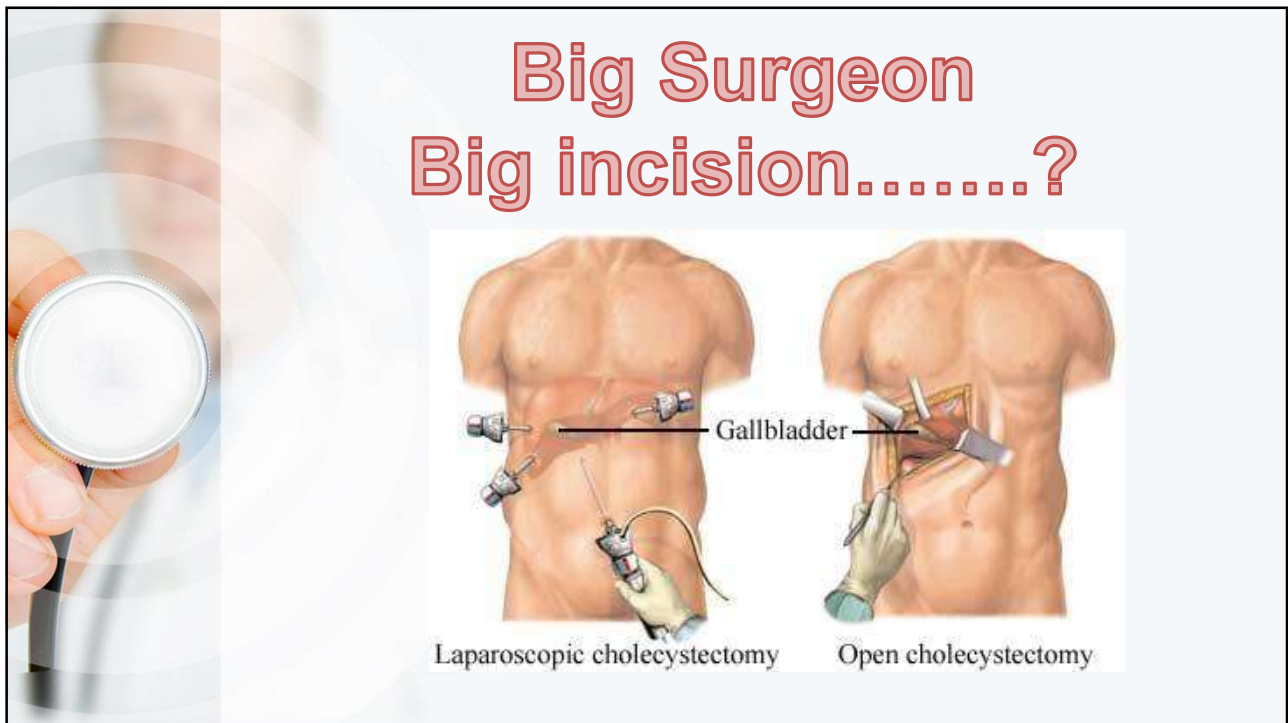
The open approach was superior for:

- A lower rate of intra-abdominal abscesses (OR 1.56 to 2.29)
- A shorter operative time (\downarrow 7.6 to 18.3 minutes)

Benefit?

Cost?

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Spleen injury



Diagnosis:

Deep peritoneal lavage?
 Ultrasound (FAST)
 Computed tomography (speed matters)

Treatment:

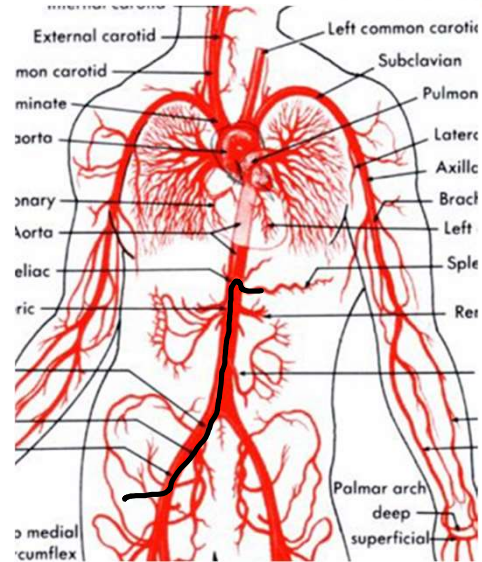
Splenectomy
 Observation
 Angiographic embolization

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Angiographic embolization



Wong, Yon-Cheong, et al. "Distal embolization versus combined embolization techniques for blunt splenic injuries: comparison of the efficacy and complications." *Oncotarget* 8.56 (2017): 95596.



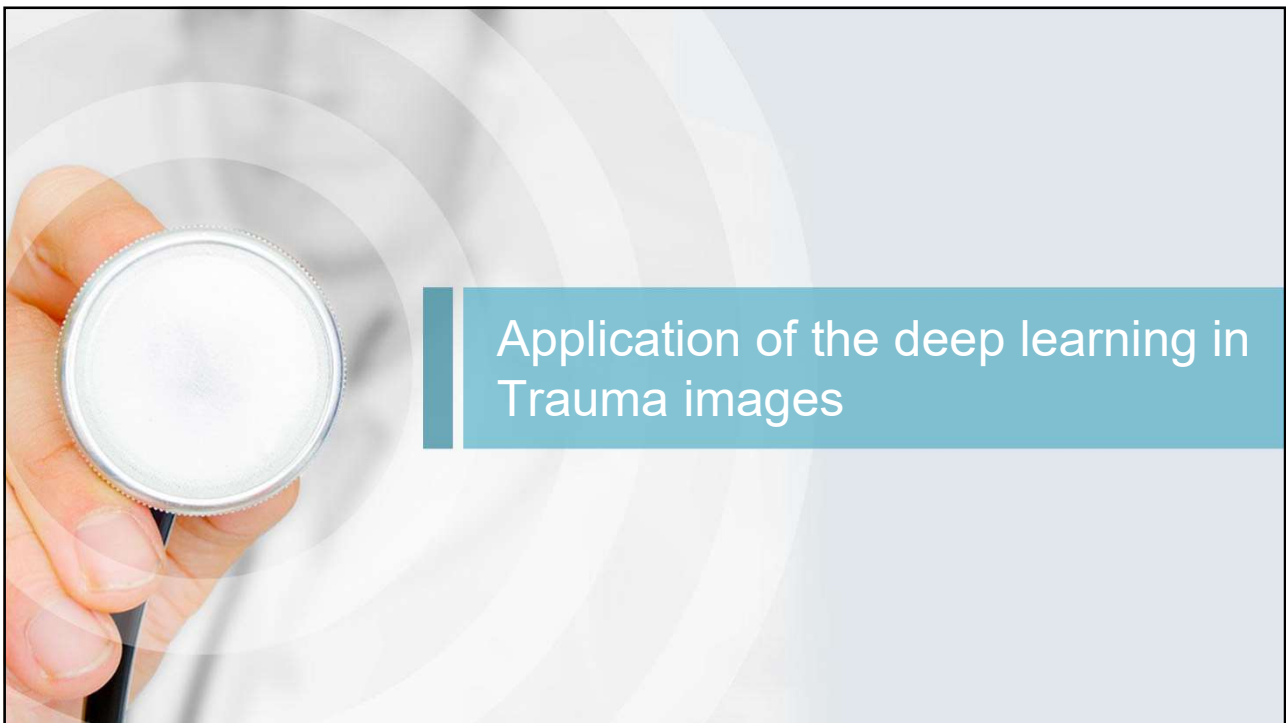
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Spleen injury

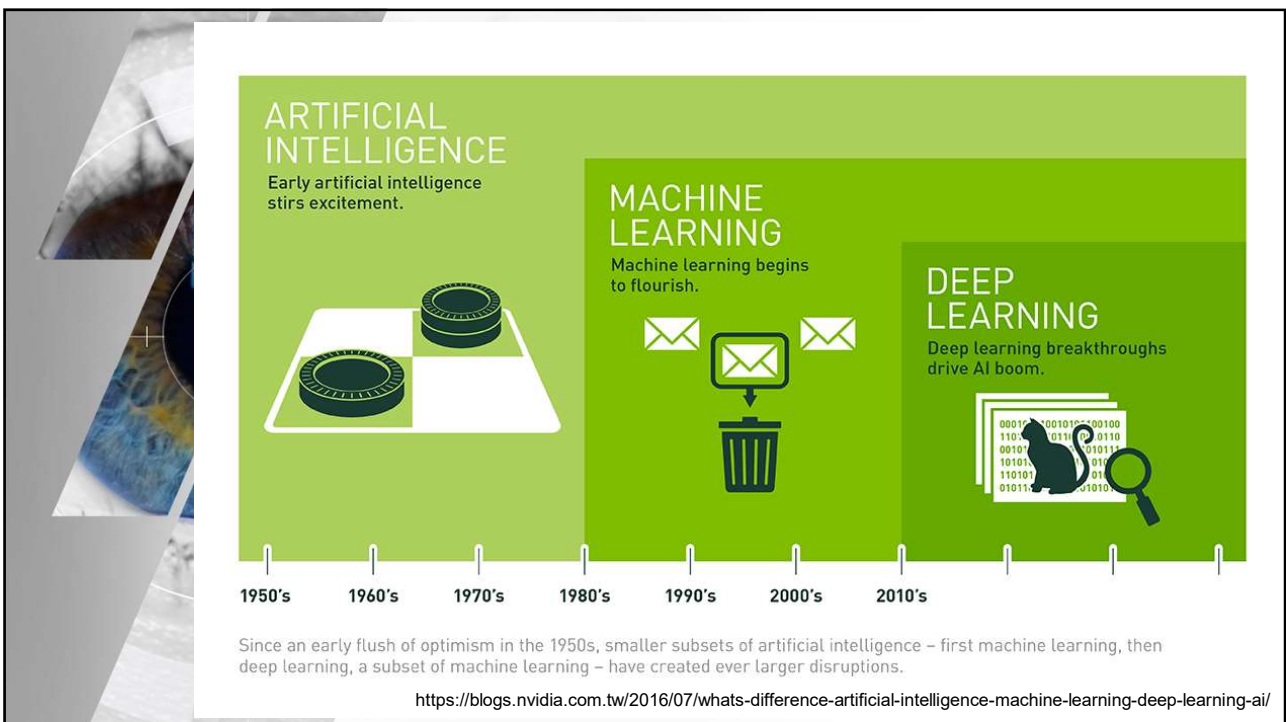


Image from <https://avantehs.com/p/ge-innova-3100-cath-angio-system/13787>

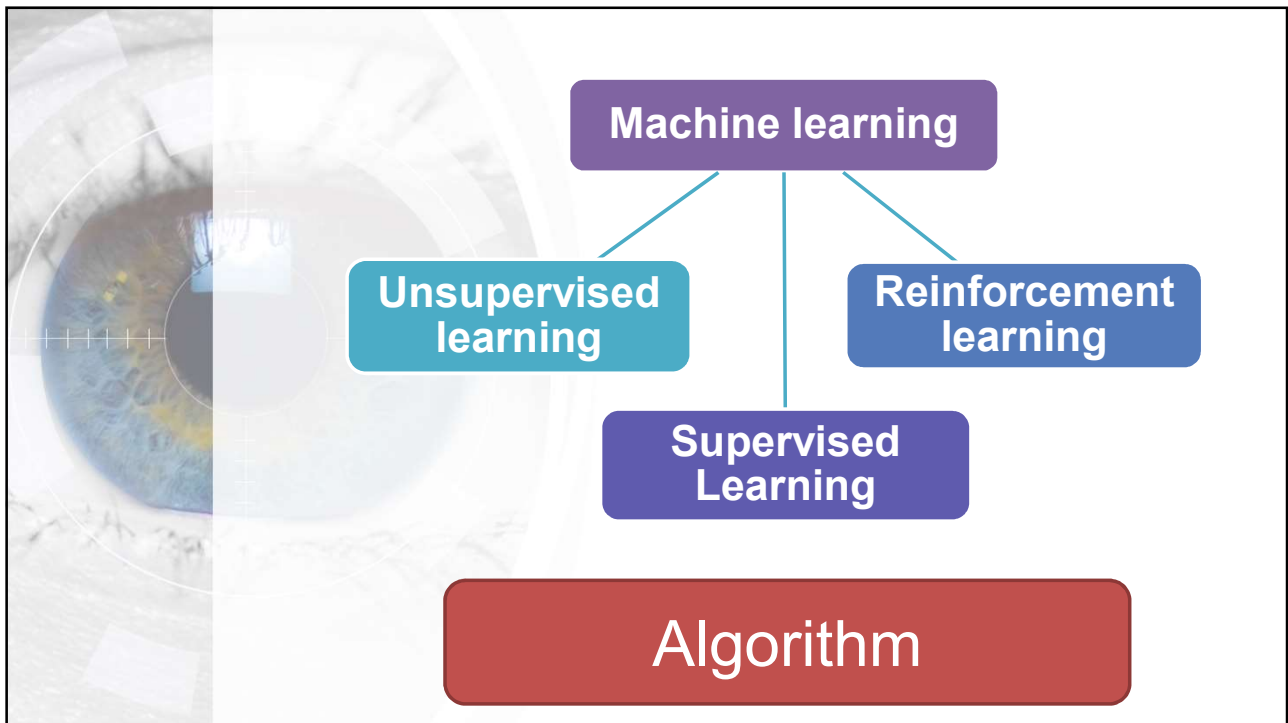
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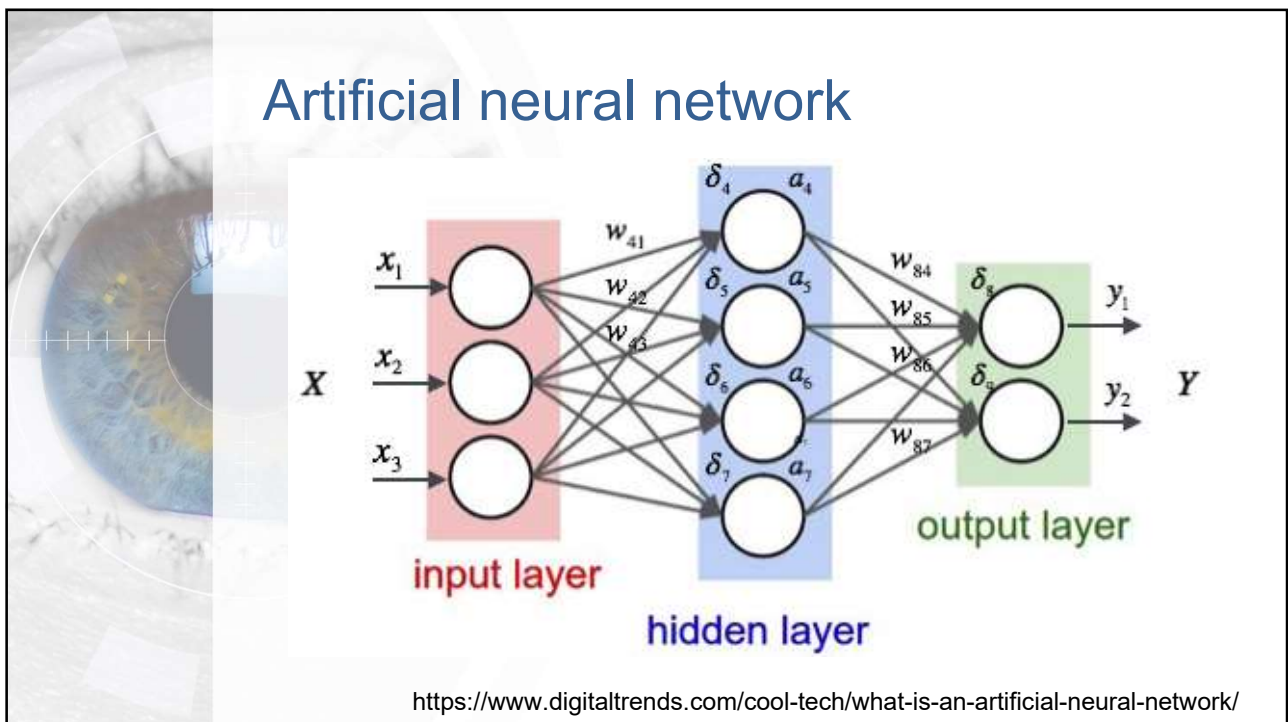
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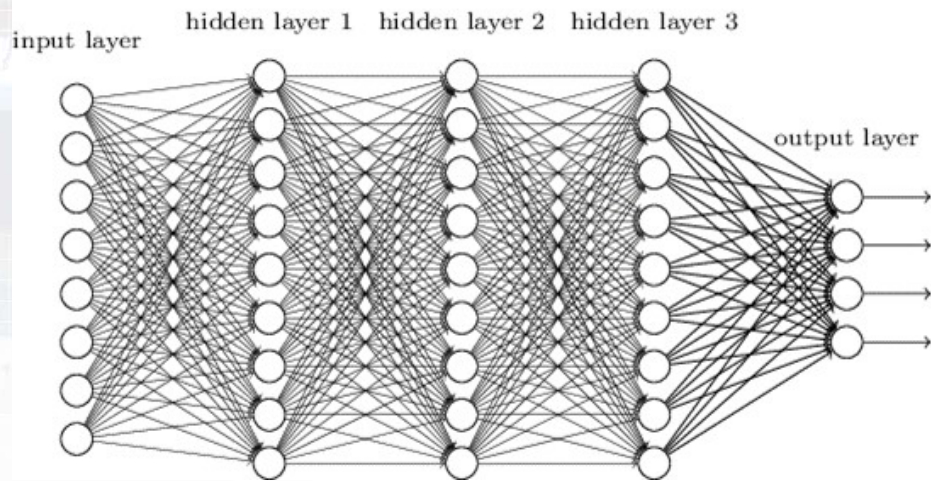


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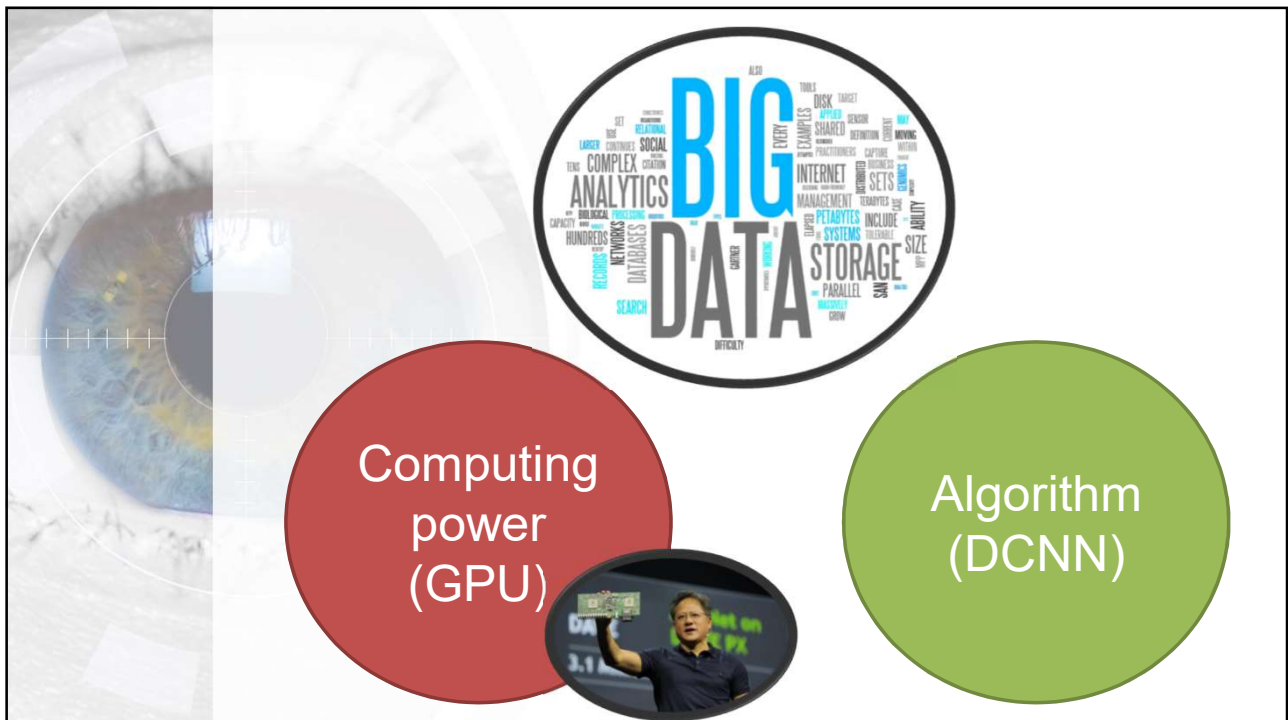


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Deep neural network



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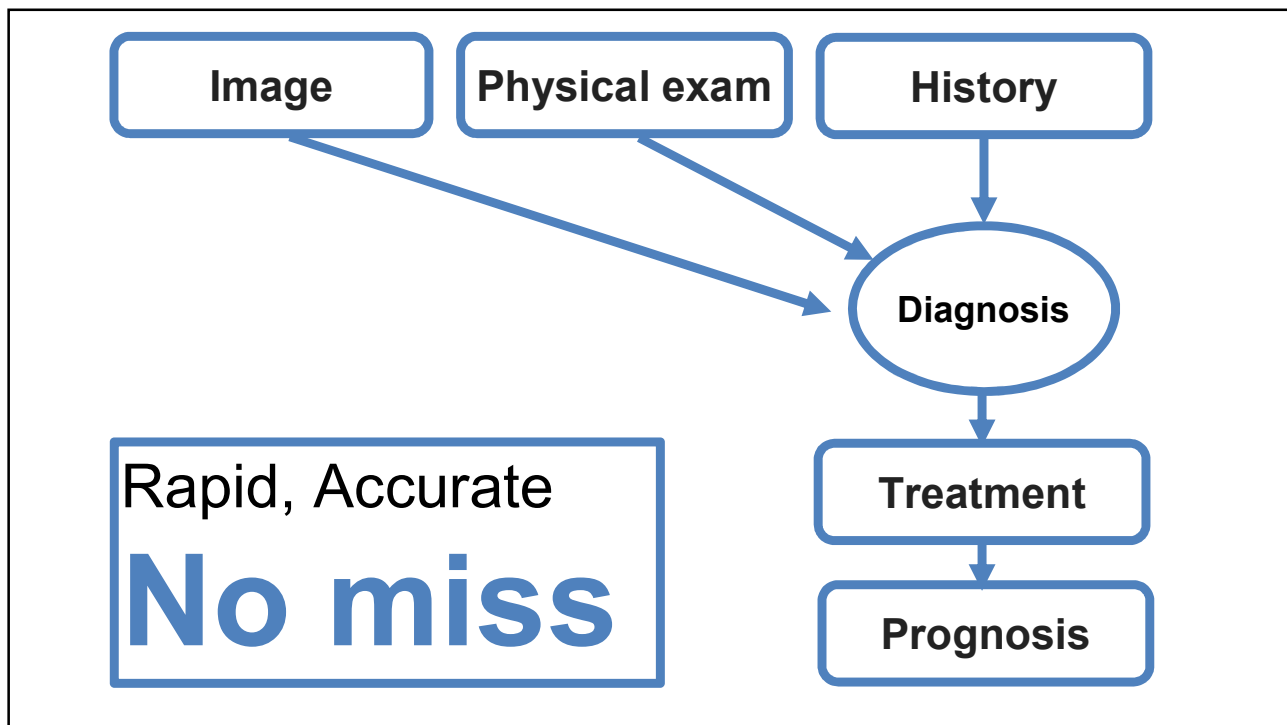
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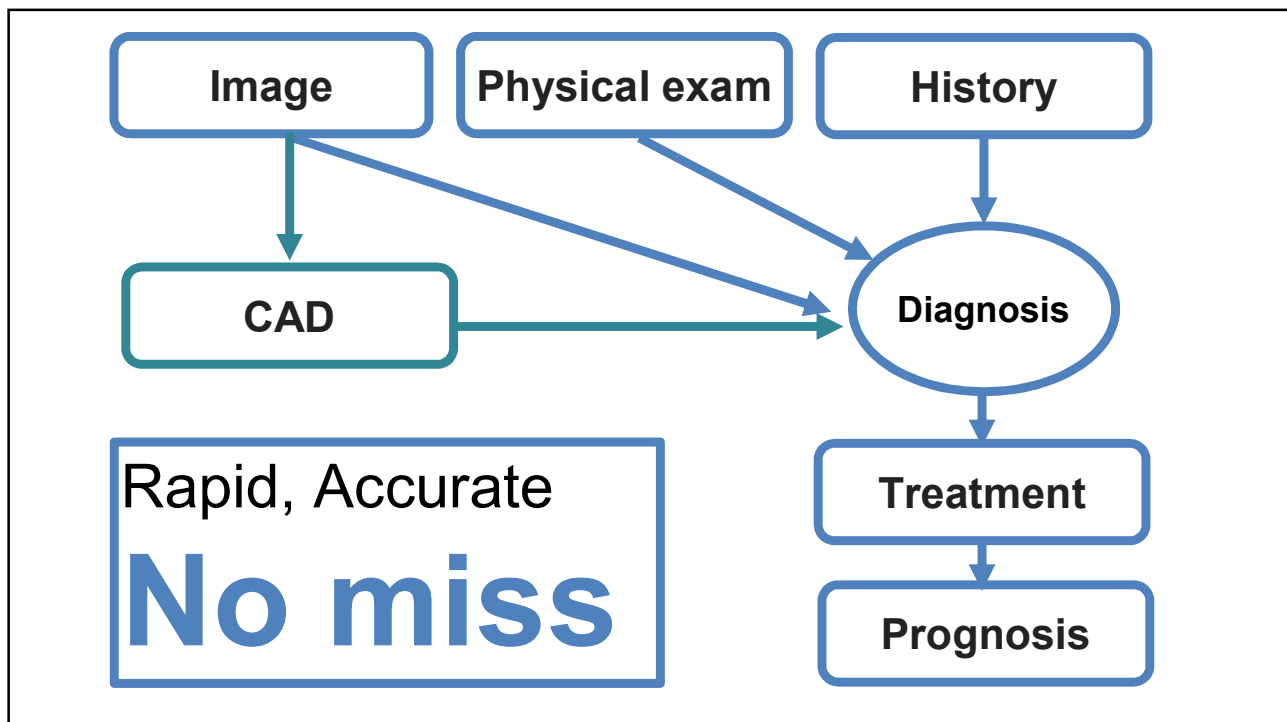
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Plain Pelvic film (PXR)
is the essential of trauma survey

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IMPACT EVALUATION

10-14% of people with a hip fracture miss-diagnosed

Miss-diagnosed hip fracture **Doubled the risk of dying**
before the end of the first postop year

Kirby et al. Radiographic Detection of Hip and Pelvic Fractures in the Emergency Department. AJR, 2010.
Cabarrus et al. MRI and CT of insufficiency fractures of the pelvis and the proximal femur. AJR, 2008.
Brauer et al. Incidence and Mortality of Hip Fractures in the United States. JAMA 2009.

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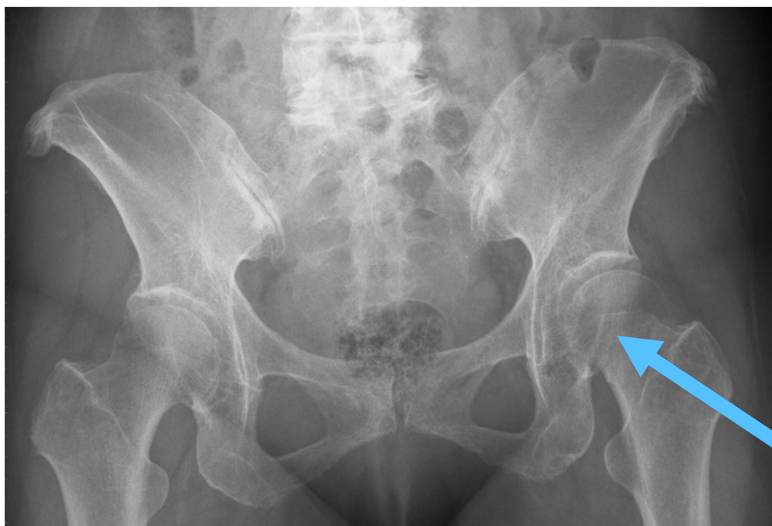


Displaced fracture



Non-displaced fracture

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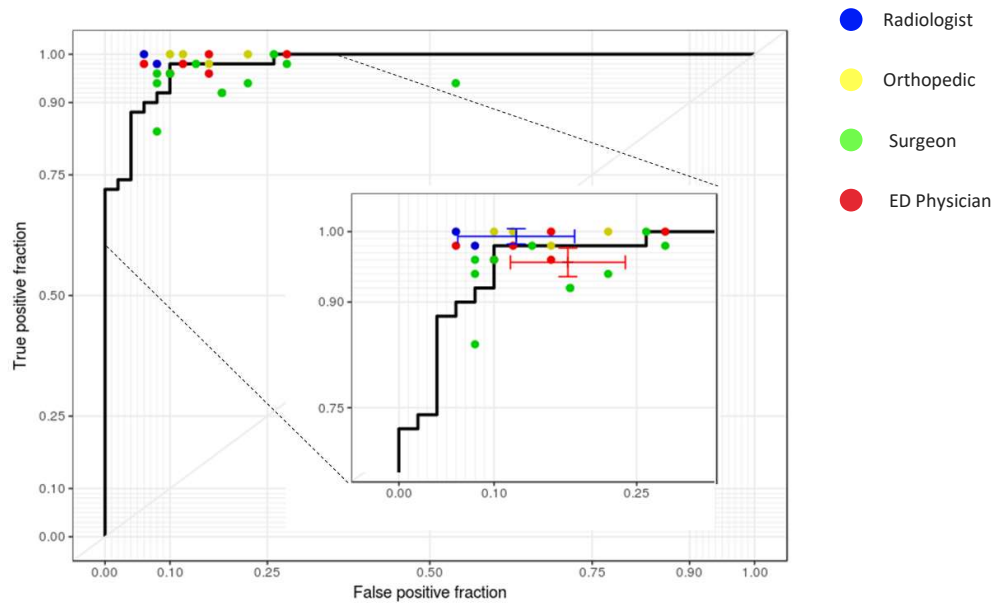
Fracture Site

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CHARACTERISTICS OF THE CASES

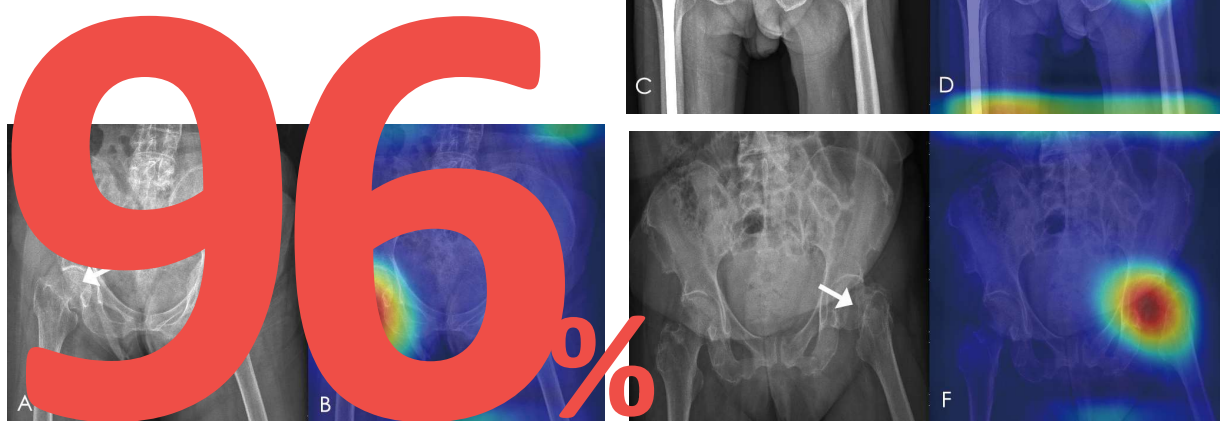
	With hip fracture	Without fracture	p-value
No.	1975	1630	
Age	72.34 (16.73)	44.88 (20.46)	<0.001
Gender	839 (42.0)	1112 (68.2)	<0.001
ISS	9.96 (4.21)	14.01 (9.29)	<0.001
Fracture type			
Femoral neck	931(47.1%)	NA	
Trochanteric	1044 (52.9%)	NA	

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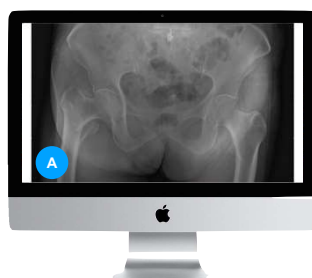
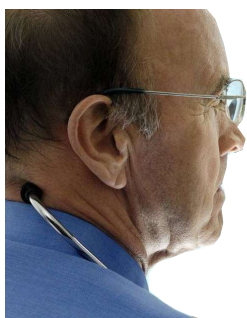
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Interpretability AI Diagnosis



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Clinical workflow



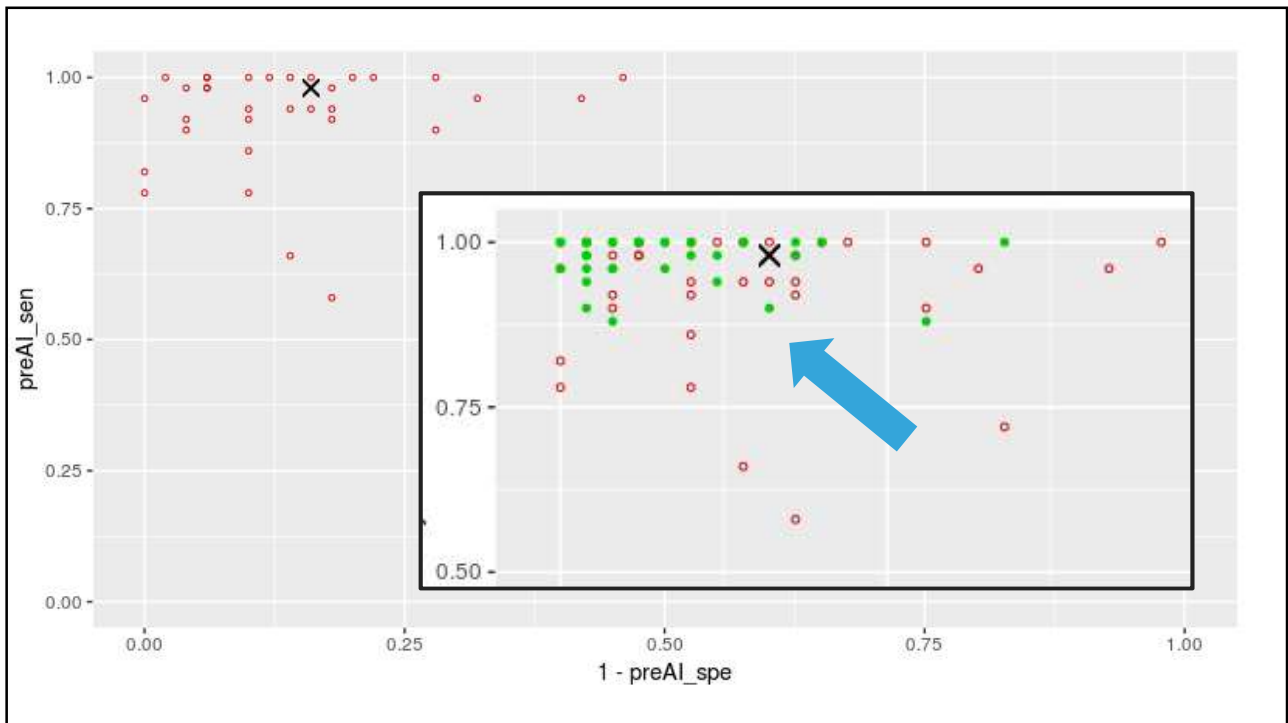
Doctor get a PXR on PACS
Press the button on window



Show PXR with heat map

Accuracy increased

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Plain Pelvic film (PXR)
is the essential of
trauma survey

HIP fracture
Pelvic fracture
Femoral shaft fracture
Hip dislocation
Periprosthetic fracture

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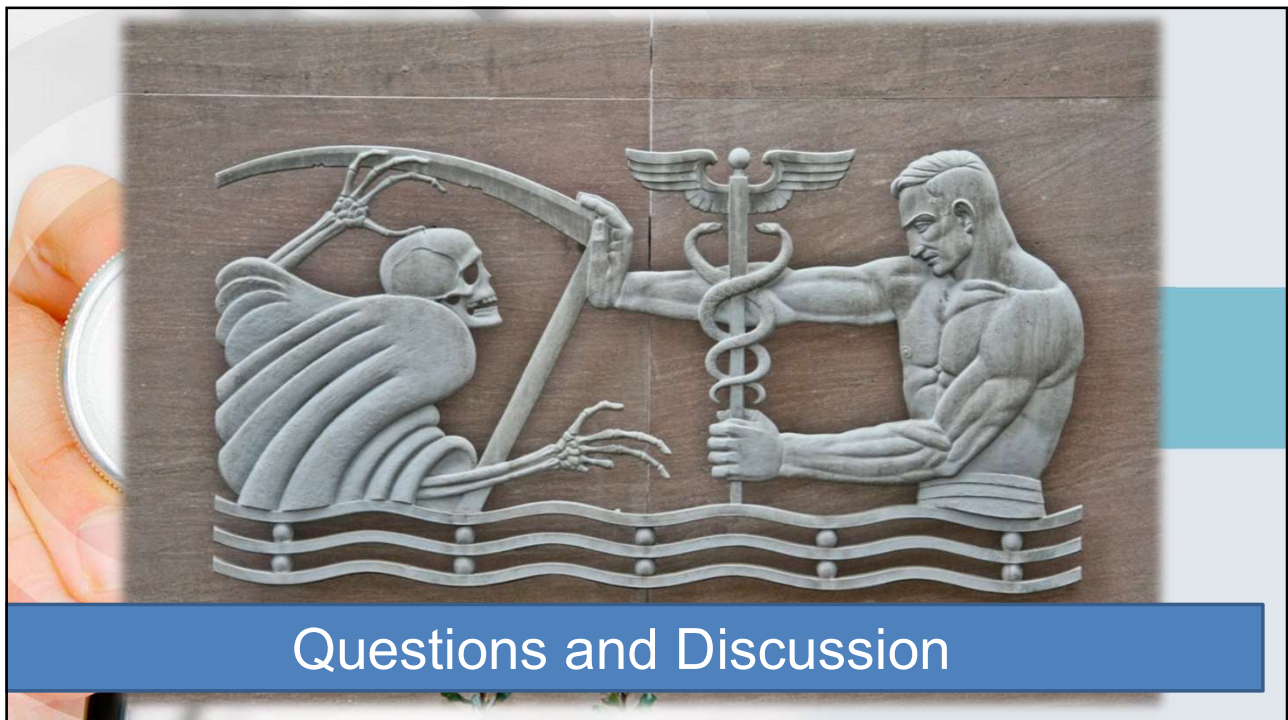
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Take home message

- Practice changes as technology advances.
Slow, but it happens
- Patient outcome is determinant.
- Try to identify the problem from clinical workflow.
- We can make medicine better!



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