

NORDICFORUM www.nordictraumarad.com
TRAUMA & EMERGENCY RADIOLOGY

Abdominal penetrating trauma

Deaths by Knife/GSW recently

Knife ca 40



GSW ca 20



Deaths by Knife/GSW 2023

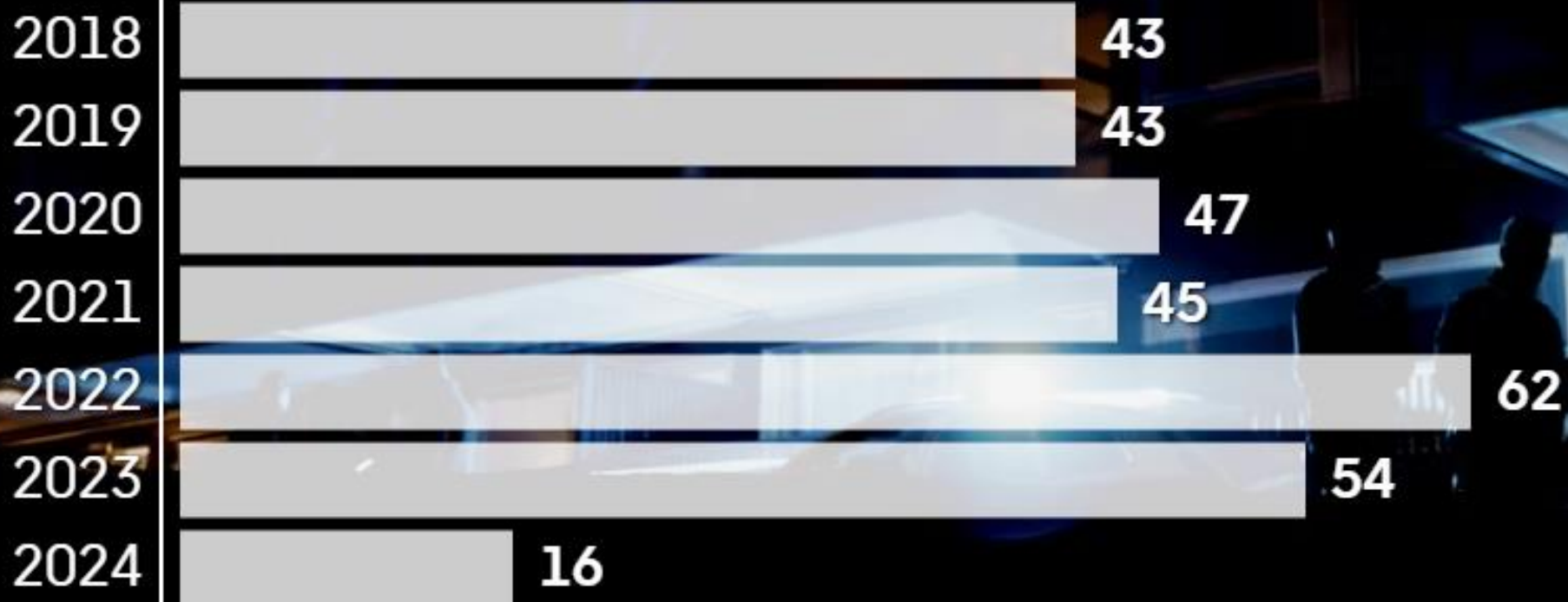
Knife 32 Wounded 831



GSW 54 wounded 110



Deaths by GSW Sweden



USA vs Sweden GSW deaths

- USA 2015, (Gun Violence Archive),
 - 13,286 killed
 - 26,819 wounded].

2021

USA 20958 homicides AND suicide 26328

6.35/100 000 homicides

Sweden 46 deaths excl suicide ca 0,46/100 000

TYPES OF FIREARMS

**REVOLVER**

Pulling the trigger turns the cylinder, positioning a cartridge before the barrel, then cocks and releases the hammer.

**SEMIAUTOMATIC**

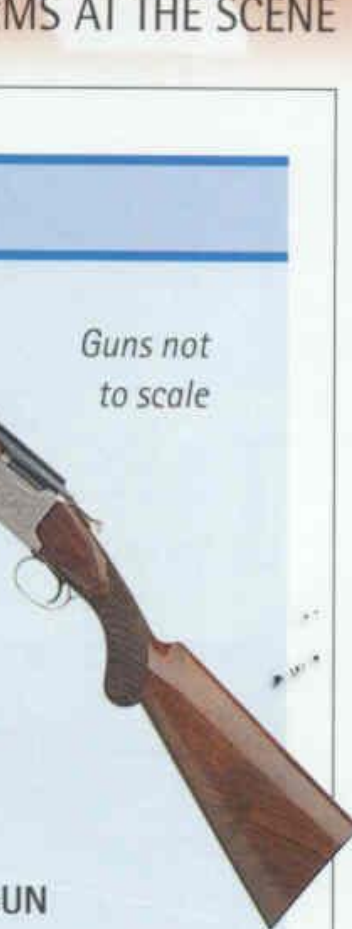
These are quicker to fire and load than revolvers: a quick-change magazine in the grip holds up to 30 cartridges.

**SUBMACHINE GUNS**

Assault rifles and submachine guns can switch between automatic and semi-automatic fire. Rifles use larger ammo.

**HUNTING RIFLE**

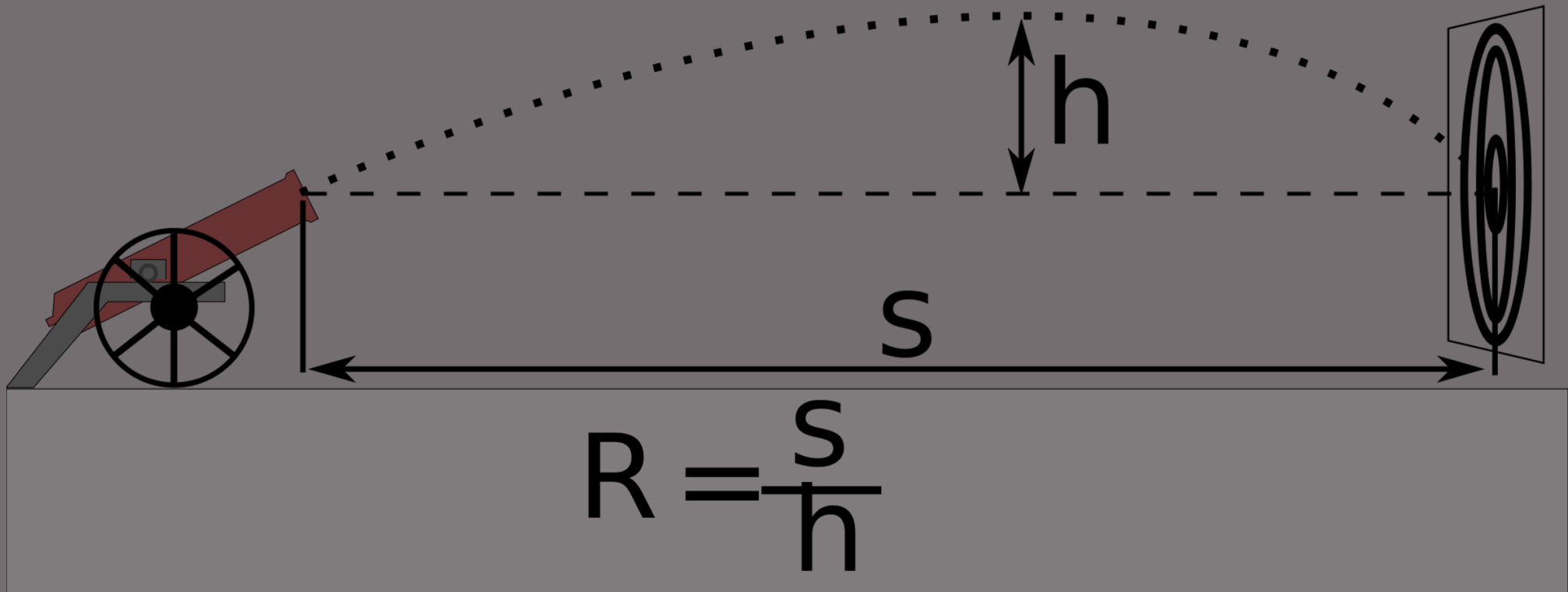
These have a hand-operated lever or slide to eject the cartridge after firing and load a fresh one into the chamber.

**SHOTGUN**

A shotgun fires a handful of small lead pellets that spread, rather than a single bullet. This reduces the need to aim.

Guns not to scale

Ballistics



Bullet types



High velocity
Low velocity
Hail shot gun

Velocity

LOW NO jacket



Velocity

HIGH NO jacket 700

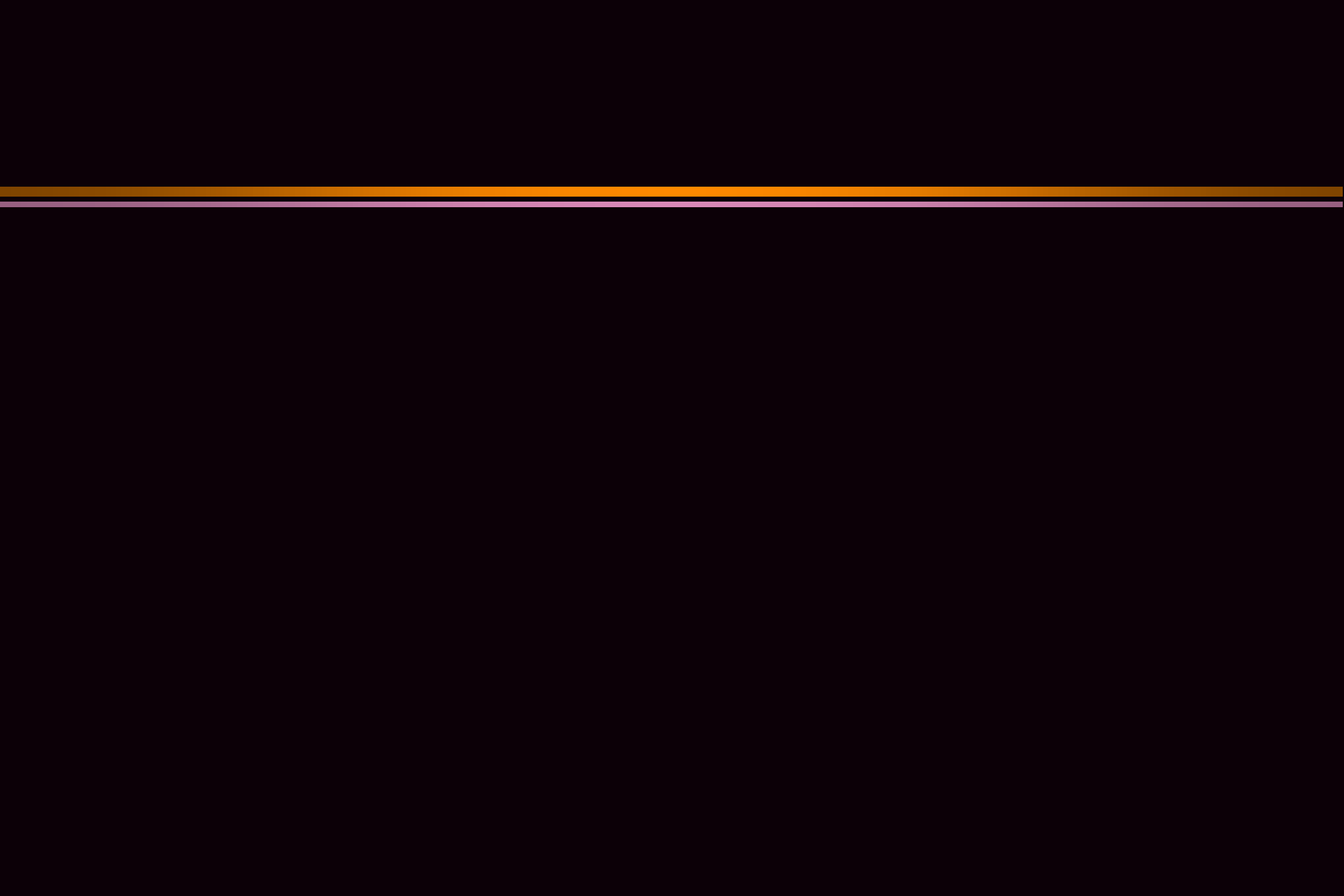


Velocity

High Velocity 900



$$E_k = \frac{1}{2} mv^2$$



Policeammunition Speers Gold Dot

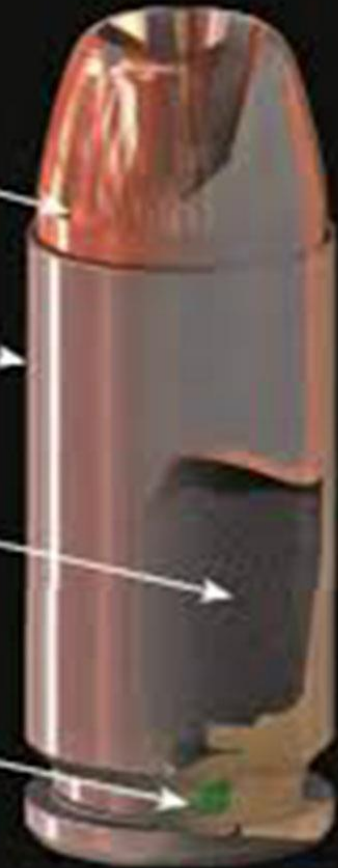


Gold Dot® technology virtually eliminates core/jacket separations and produces a very uniform jacket for great accuracy

Nickel-plated brass cases for smooth functioning and durability

Select, clean-burning propellant for low-flash, optimum velocities, and the shot-to-shot consistency you need

Non-corrosive, non-mercuric CCI® primers for reliable ignition under tough conditions



gel test speer gold dot



Abdomen?? Torso.

- | From nipple to upper third of thigh
- | In Practice part of SWB-CT
- | Includes A LOT of organs

E- vitamine marker

PENETRATING TRAUMA AND THE USAGE OF E-VITAMIN CAPSULES

Souzana Bellou MD, Mats O. Beckman MD, Anders Sundin MD PhD, Institution of molecular medicine and surgery, Karolinska Institutet and Department of Radiology Karolinska University Hospital Solna

Conclusion:

The majority of skin wound openings are not visible independently of the type of injury but the usage of E-vitamin capsules made all them visible. The diagnosis of injuries was easier and faster by pinpointing directly the area of interest. The radiologists can faster recognize or predict the injuries by following the knife / bullet tract. By counting the marked openings and by making a 3D analysis they can also help evaluate the type of weapon, the length of the knife and even reconstruct the direction of the wound track. This may be of forensic importance.



Fat attenuating E-vitamin capsules, without and with surgical tape, leave no artifacts on CT.

Results

51% of the wound openings are caused by knife and 49% by gunshots. Without taking into-account the usage of E-vitamin capsules 49 % of openings are not visible on CT-scans, 38,5% are detectable and 12,5% are questionable, not clearly identified. So the majority of openings is not visible independently of the type of injury. There may be a slightly increased possibility to see an opening after a gunshot. (table 3).

No of openings that are	Not visible	Visible	Partly visible/questionable
Knife	24	18	7
Gunshot	23	19	5

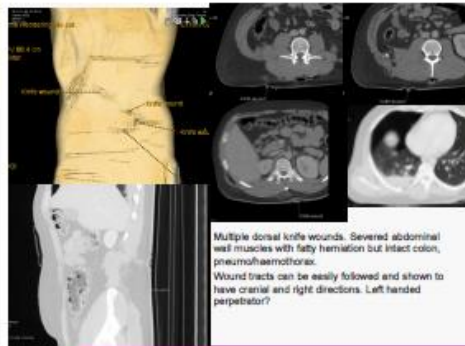
Purpose

To evaluate the usage of E-vitamin capsules in a trauma MDCT in detecting injuries in patients admitted to ER after a penetrating trauma.

Materials and methods

Penetrating trauma is routinely examined with CT for possible torso organ injury. E-vitamin capsules are applied to wound openings to facilitate CT evaluation. CT workstations are routinely used, where the fatty E-vitamins are readily appreciated. A cursor placed on each capsule allows immediate wound tract evaluation in MPR views with preset window settings for soft and lung windows.

We retrospectively evaluated 50 patients with penetrating trauma between 2005-2012, 3 women and 47 men who admitted to ER after a knife or gunshot trauma and underwent MDCT (5450e-sv contrast). The number of traumatic openings, their cause and their distribution throughout the body was identified. Some openings were marked with E-vitamin capsules whereas some others were not. The usage versus not usage of E-vitamin capsules was then evaluated.



Abdominal stab wound, small extravasation, no penetration to abdominal cavity.

Results

E-vitamin capsules were used in 84,5% of total number of openings. With the capsules all the openings, even those which could not be directly identified became visible because all the capsules were clearly identified on CT-scans without causing an artifact (table 4)

No of openings that are	Use of E-vitamin No of openings (No of patients)	Not use of E-vitamin No of openings(No of patients)
Not visible	44 (21 patients)	9 (3 patients)
Visible	26 (13 patients)	11 (9 patients)
Partly visible	12(3patients)	1 (1 patient)

Results

64% of traumas were caused by knife and the rest by gunshots. 41,5 % of all injuries occurred in the abdomen and the rest were distributed throughout the body (table 1).

	Brain/face	neck	thorax	abdomen	extremities
Knife	3	3	11	18	6
Gunshot	3	0	2	9	10

In the majority of cases (56%)there was only one opening regardless the type of trauma. There is a tendency to have more openings with gunshots where 16,7% caused >5 openings in comparison to 6,2% of knife traumas with > 5 openings (table 2)

No of openings	1	2	3	4	≥5
Knife	20	7	2	1	2
Gunshots	8	4	3	0	3

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PENETRATING TORSO (TRUNK) INJURY

- **EMERGENT SURGERY** when needed
 - **IMAGING IN ER**
 - Unstable patients have eFAST[#] and chest X-ray
 - » Cave: Box of death. Large hemothorax may conceal hemopericardium
 - » Wound marking recommended by e.g. paperclip *
 - » If CT is not available, stable patients may have eFAST and chest X-ray on ER
 - Pre-CT-imaging is, however, not encouraged
 - **WHAT RADIOLOGY EXAMS SHOULD BE PERFORMED IN STABLE PATIENTS (to help to decide to operate or not, and to guide the surgeon and/or interventionist)**
 - » Use CT scouts to localize foreign bodies in GSW to define the optimal FOV
 - » CT chest-abdomen with i.v. contrast, especially if the entry wound is below intermammary line in stab wounds and almost always with GSW.
 - Consider triple contrast CT. (Level II Evidence). (See also examples on indications and contraindications on next slide.)
 - late arterial (to visualize arterial injuries) to lesser trochanters+ venous phase upper abdomen.
 - Add late phase (5-10 min delay) if kidney and ureter are in injury trajectory. Radiologist's supervision required
 - CT cystogram should be performed in urinary bladder injuries
 - Wound marking strongly recommended, paper clip/E-vitamin capsule etc.*
 - *CO₂ DSA can be used in unequivocal cases with suspected vascular injuries*
 - *Peroperative angiogram is not discussed here*
 - *Angioembolization is part of management and not discussed here*
- *Based on local practice
eFAST = FAST + bilateral anterior and lateral chest views (rule in hemopericardium, hemo- and pneumothorax)

Technique

- | In ER room

- | FAST

- | Chest AP

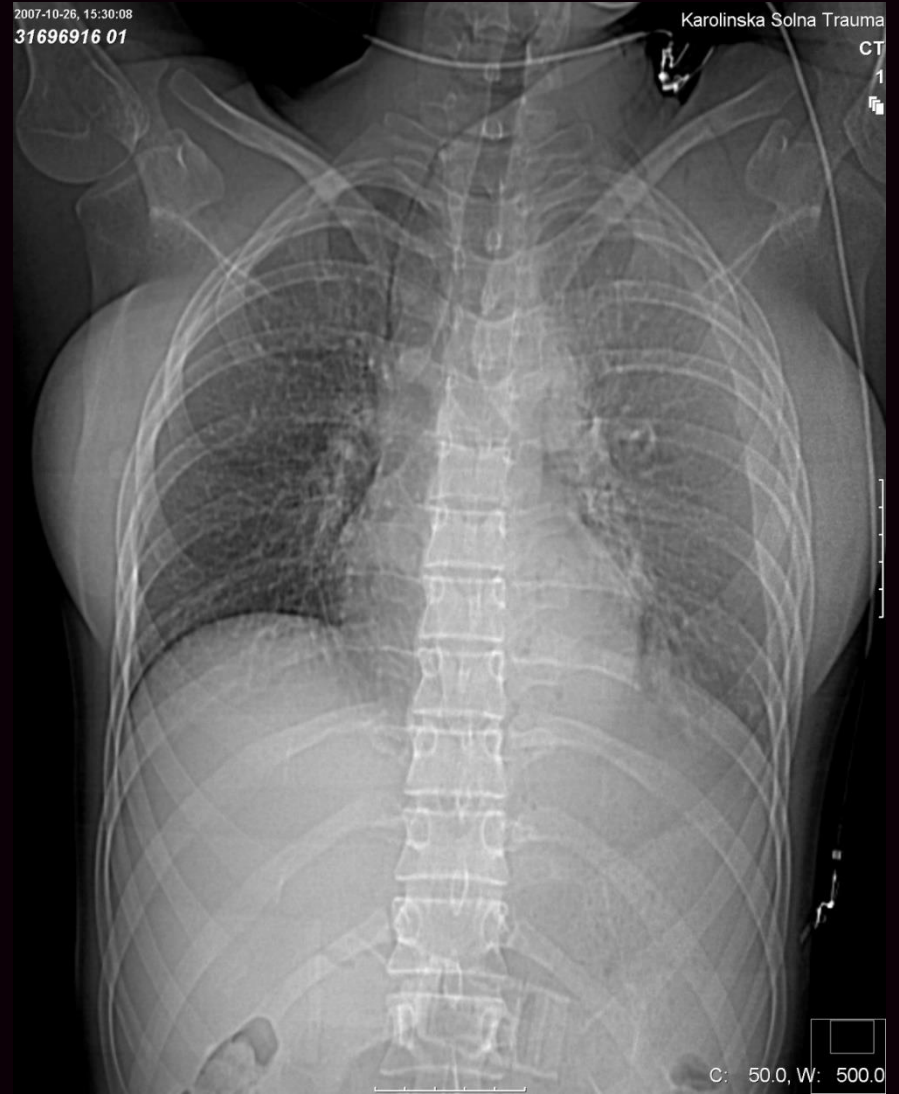
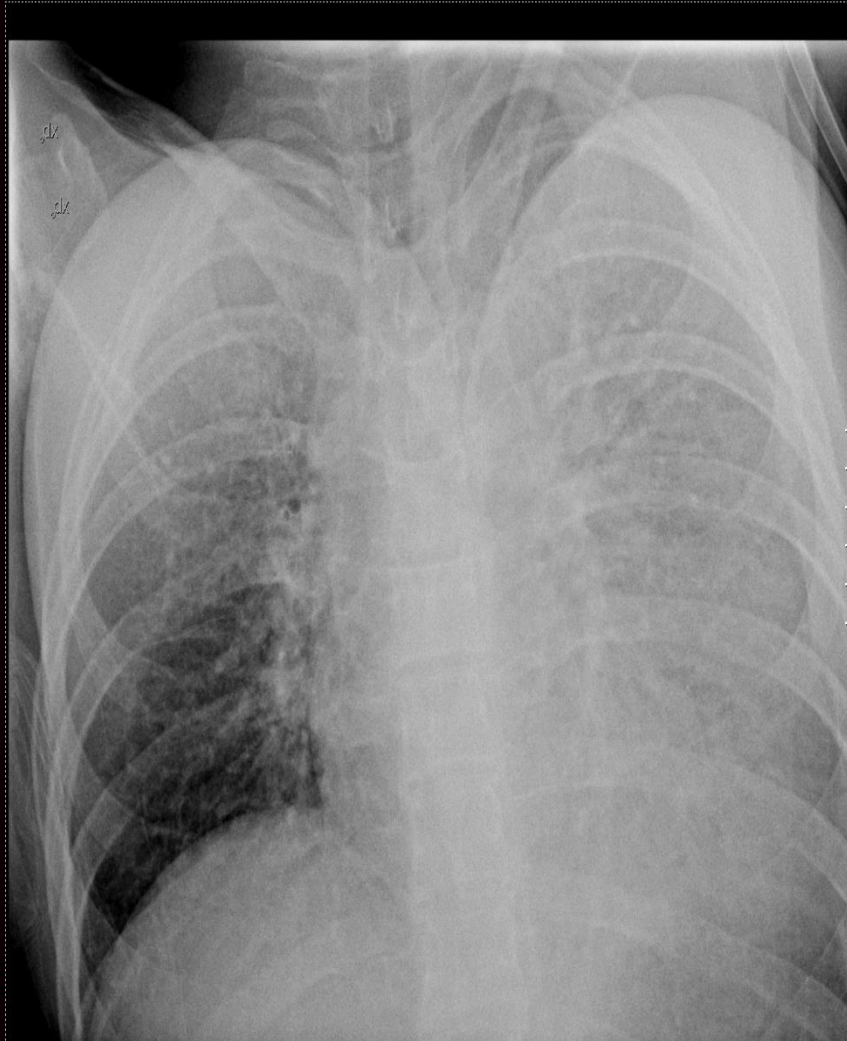
- | CT

- | Triple contrast

- | Late excretion series

- | Cystograms

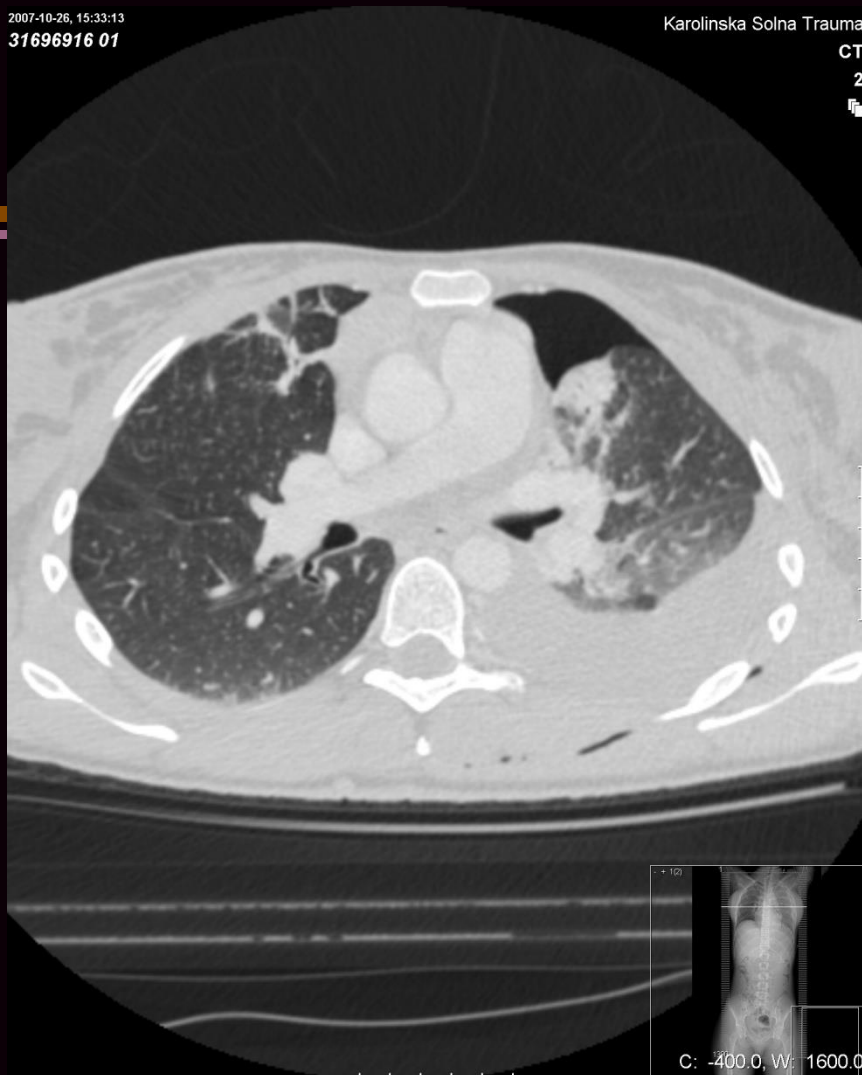
Stabbed in back. Prone examination.



2007-10-26, 15:33:13
31696916 01

Karolinska Solna Trauma

CT
2



2007-10-26, 15:33:13
31696916 01

Karolinska Solna Trauma

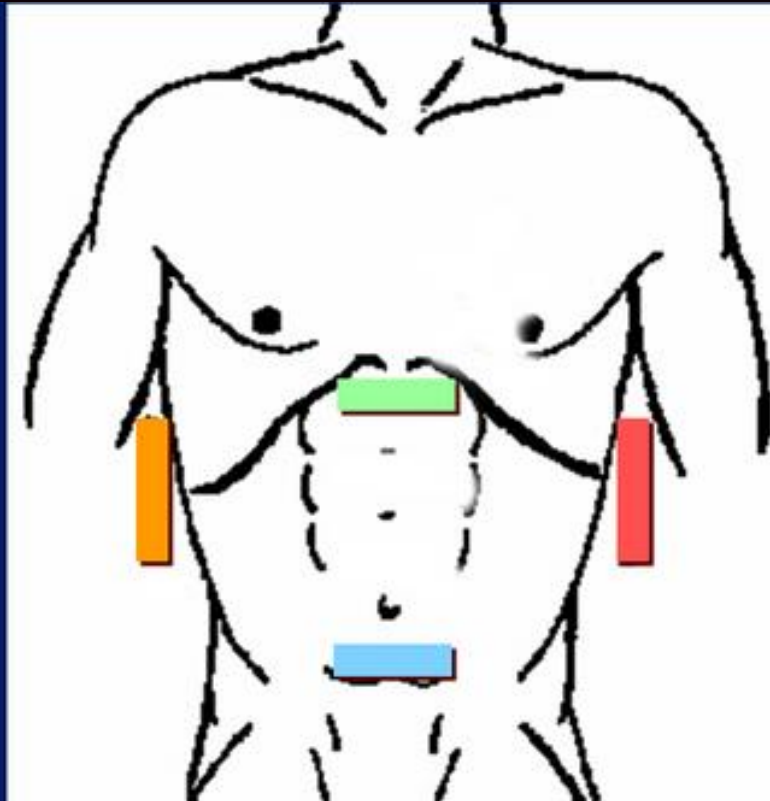
CT
5



FAST, E FAST

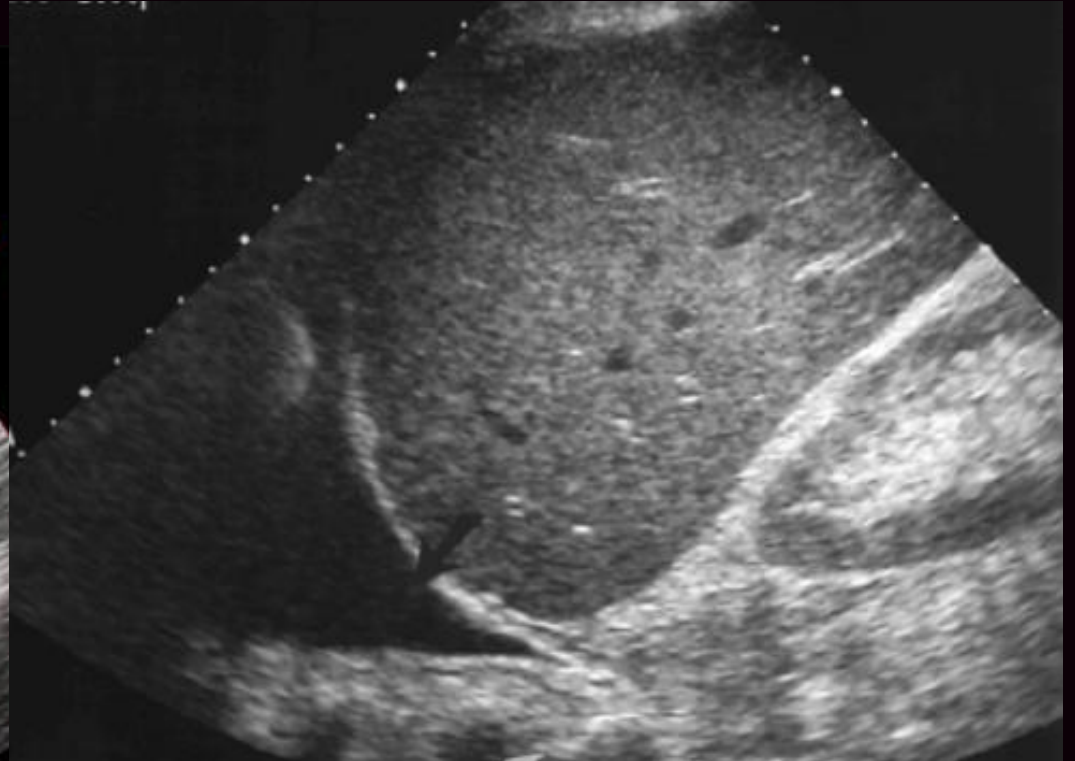
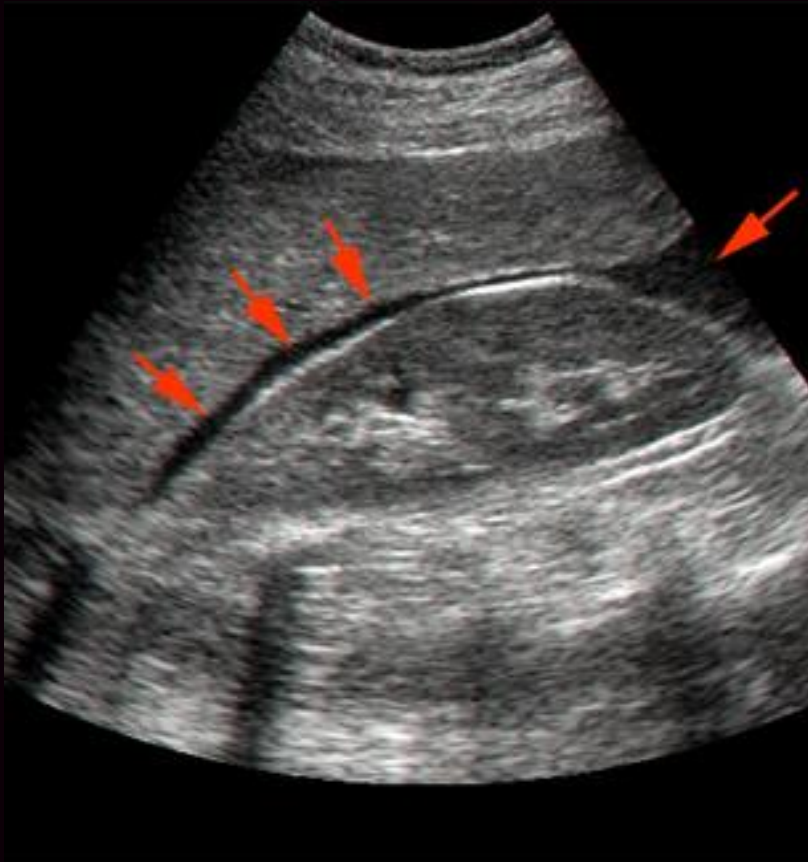
= Focused Assessment with Sonography in Trauma

- Perihepatic
- Pericardial
- Perisplenic
- Pelvic



- | Fluid?
- | Lung sliding?

Right flank



Left flank & subxiphoid



Triple contrast CT

- | Iv contrast arterial and venous
- | Split bolus
- | Oral contrast
- | Rectal contrast
- | Bladder contrast

Peritoneal violation ?

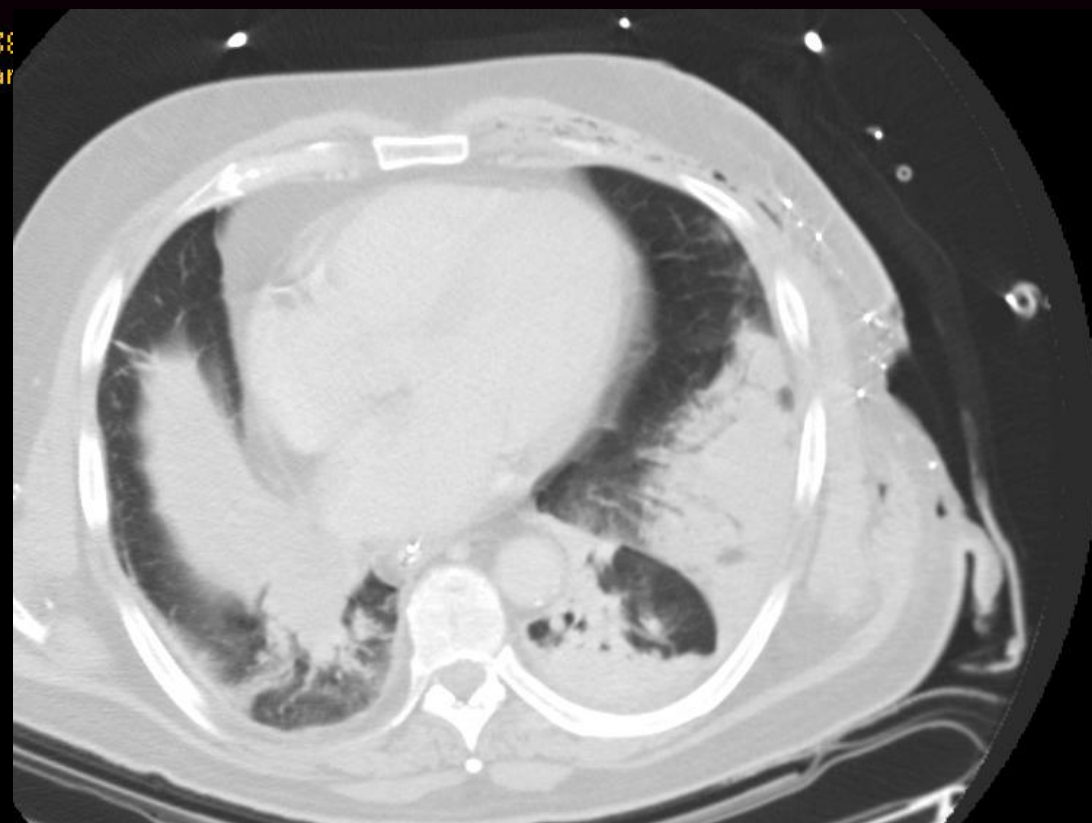
- | Free intraperitoneal air
- | Free fluid
- | Organ injury
- | Wound tract indicating injury
- | Positive CT

Stabbed flank

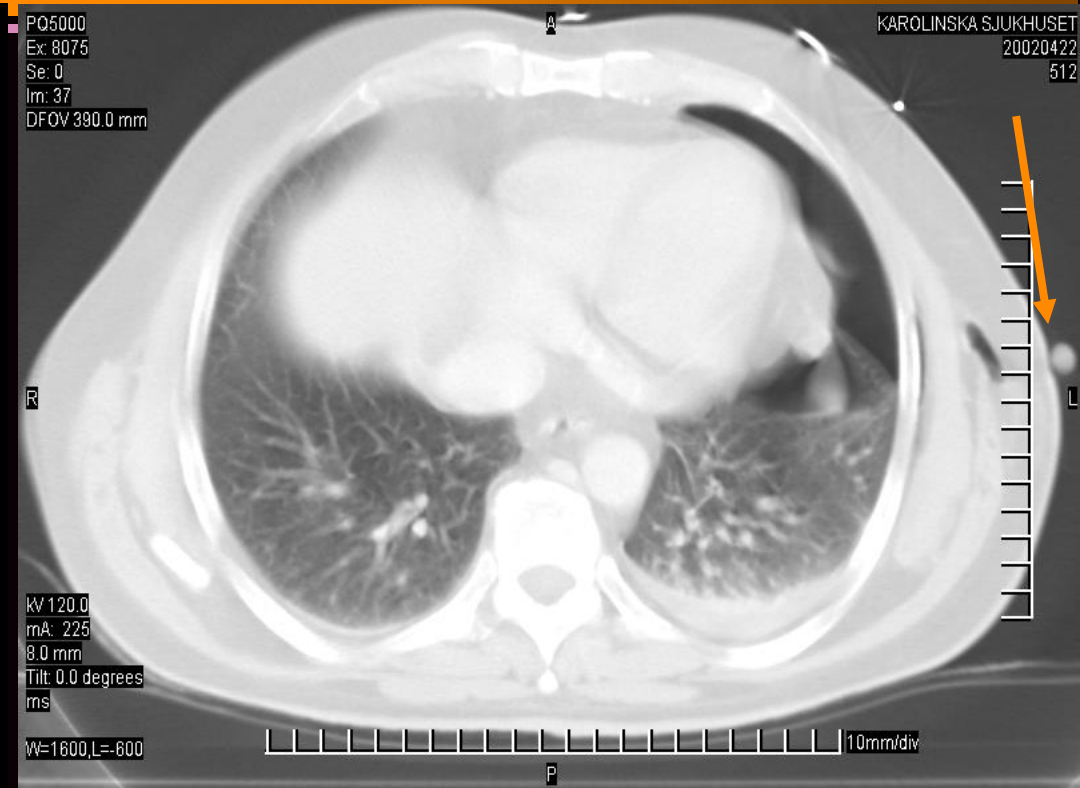
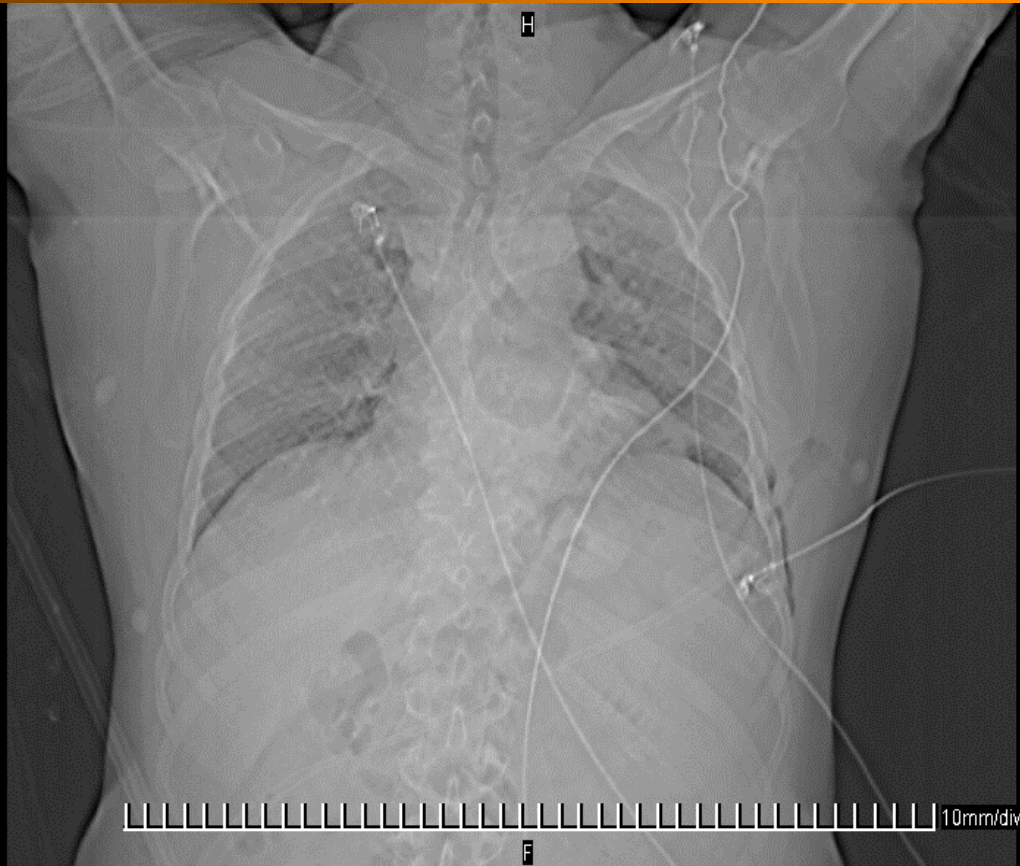


- | Extravasation, haematoma

Gunshot



Knife 1 sin 2 dx



Eviminecapsule

Knife left flank

3D
Ex: 27098
Se: 4 +c
Volume Rendering No cut

S 36

KAROLINSKA SJUKHUSET ADR

M 992006686519
Nov 02 2006

Axial
Ex: 27098
Se: 4 +c
I: 234,5
Im: 180

A 87

KAROLINSKA SJUKHUSET ADR

M 992006686519
Nov 02 2006

DFOV 52.0cm
SOFT

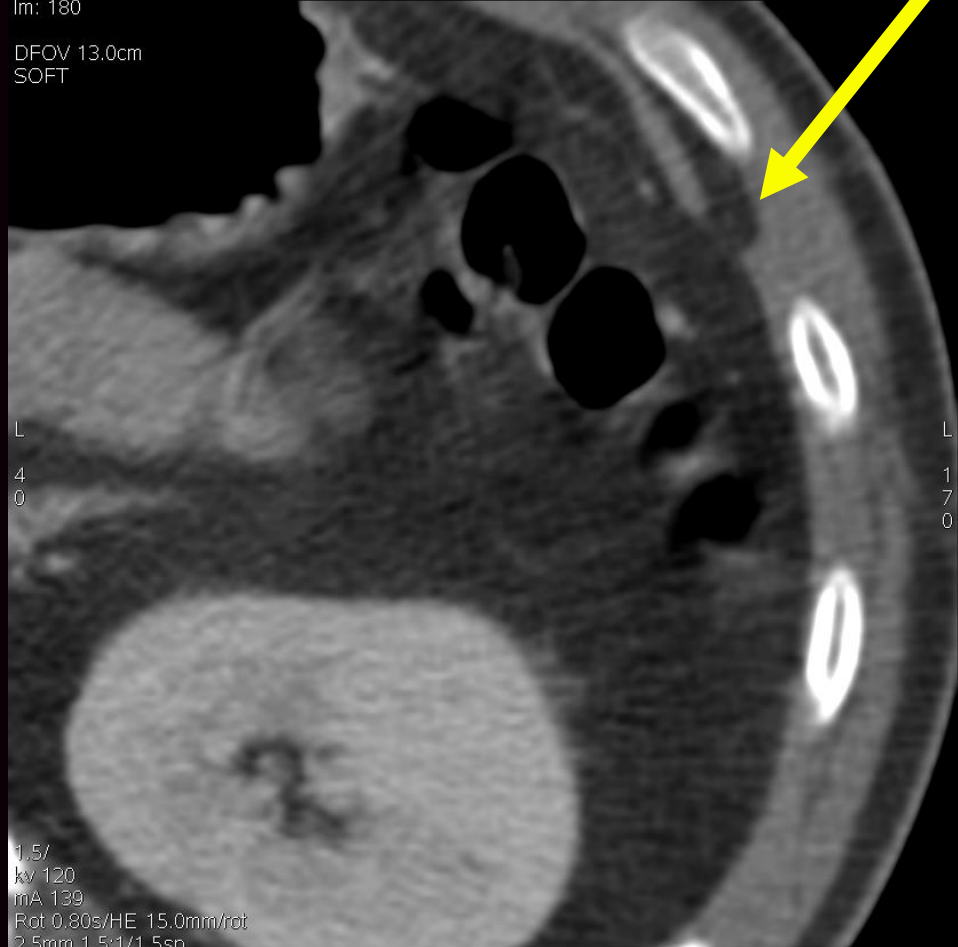


R
A

No VOI
kv 120
mA Mod.
Rot 0.80s/HE 15.0mm/rot
2.5mm 1.5:1/1.5sp
Tilt: 0.0
10:28:14 AM
W = 4095 L = 2048

I 594

DFOV 13.0cm
SOFT



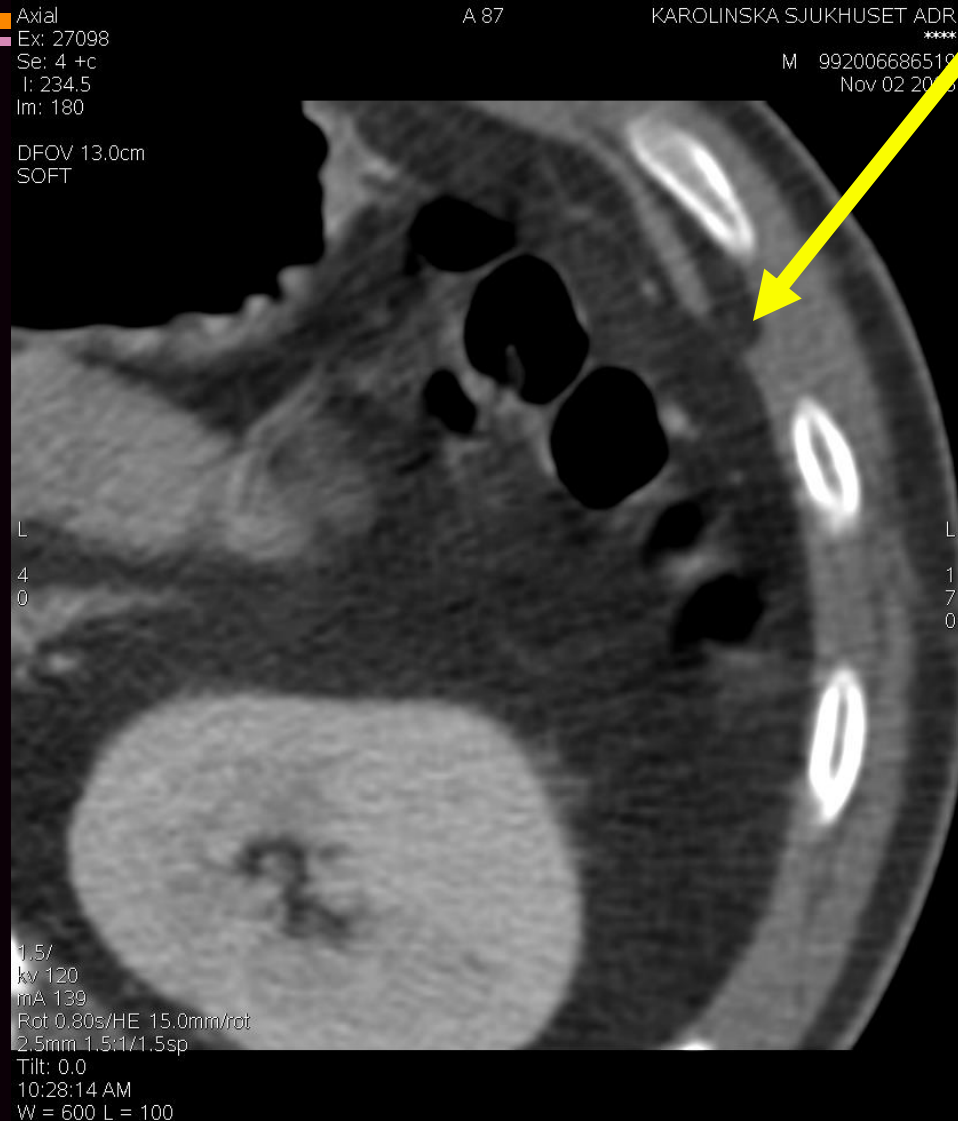
L
4
0

1.5/
kv 120
mA 139
Rot 0.80s/HE 15.0mm/rot
2.5mm 1.5:1/1.5sp
Tilt: 0.0
10:28:14 AM
W = 600 L = 100

P 71

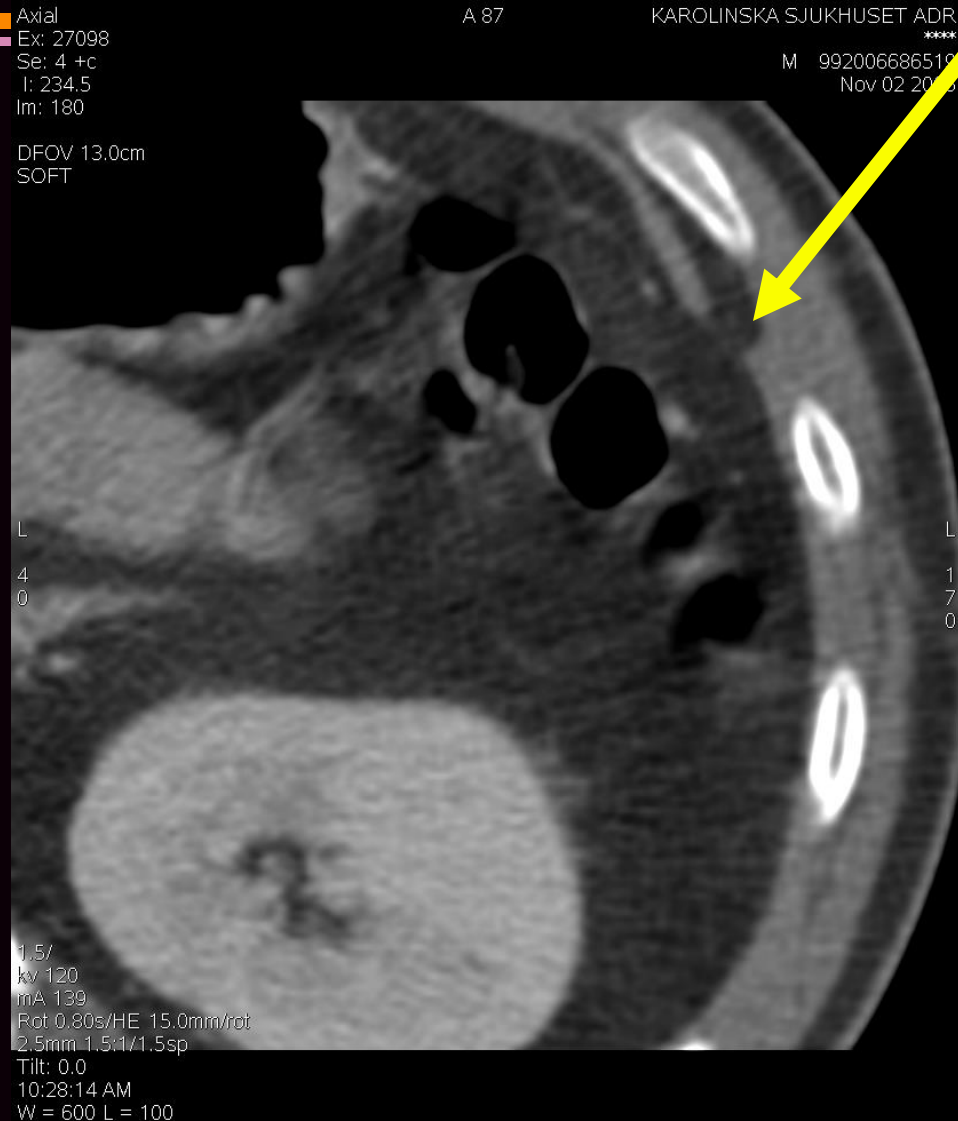
Knife left flank

- | Operated laparoscopically
- | 2 sutures in diaphragm

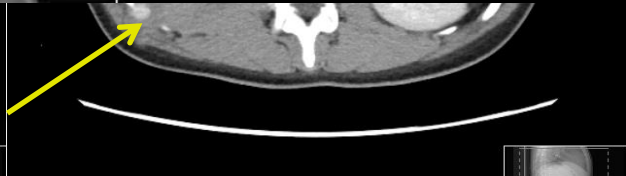
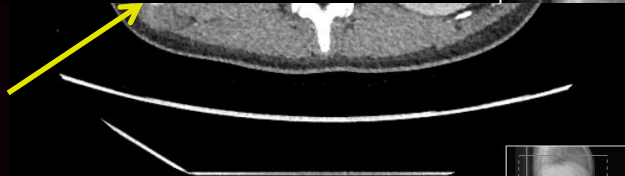


Knife left flank operated. Why?

- | Operated laparoscopically
- | 2 sutures in diaphragm
- | Risk of colon herniation

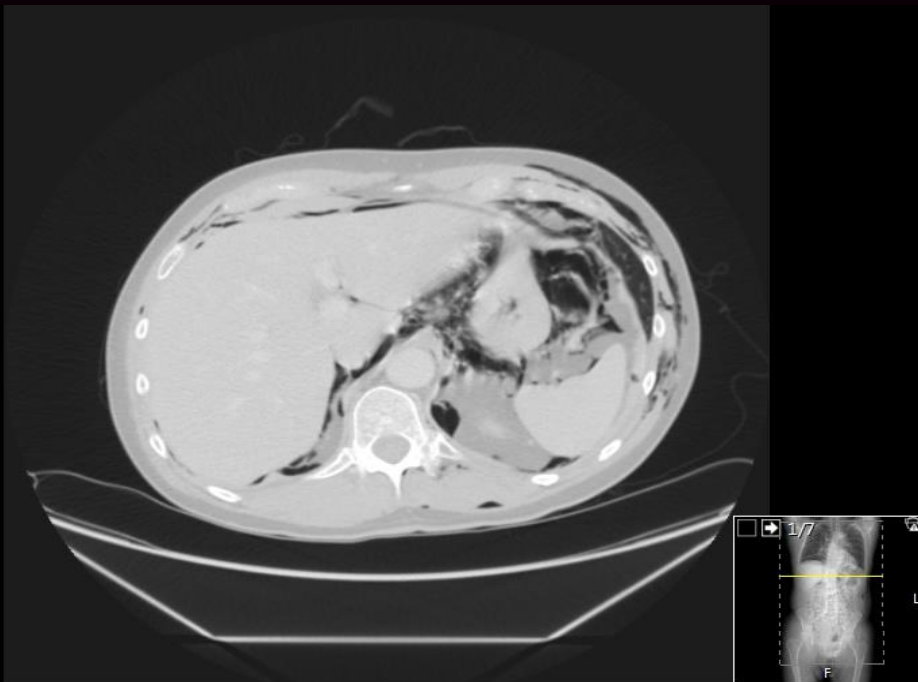


Knifed, pseudoaneurysm 2w later "Smoking gun"!





Drug addict, MIA but returned







Bowel injury

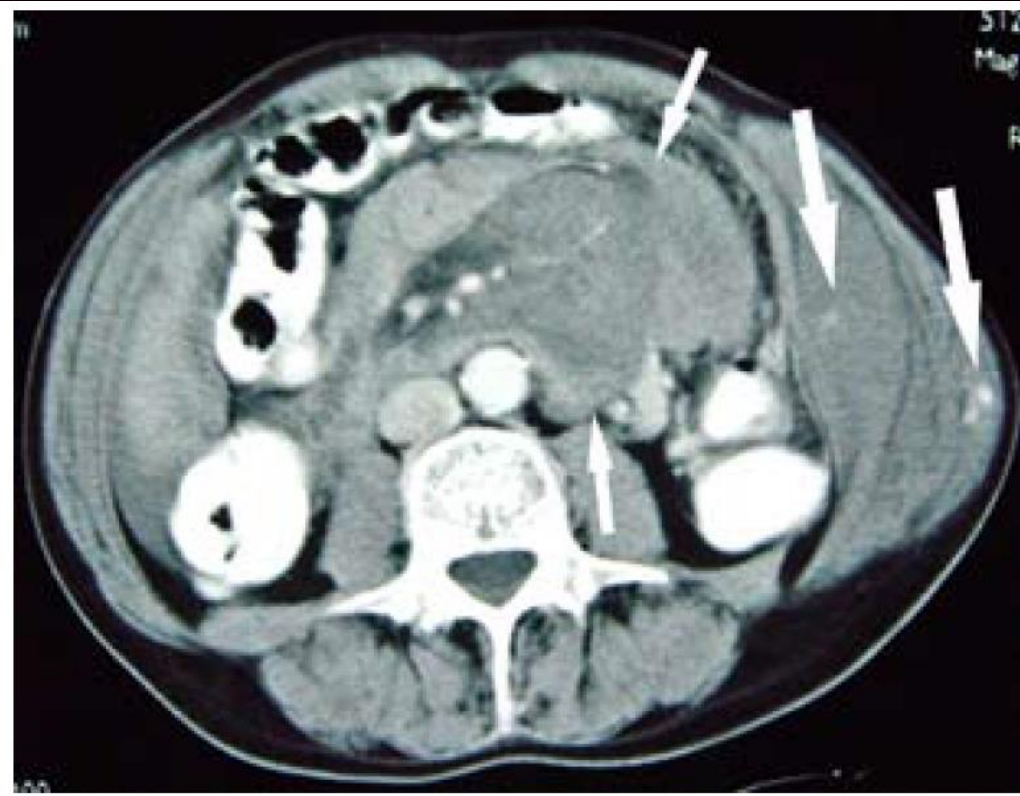
- Contrast extravasation
- Content extravasation
- Bowel wall thickening

- Wall defect, wound tract to bowel

Bowel injury

	Blunt		Penetrating	
	SEN	SPE	SEN	SEP
FA	++	+++++	NA	NA
FF	+++++	++	NA	NA
OCE	+	+++++	++	+++++
BWT	+++	++	++++	++++

Knife left flank rectal contrast leak Mesenteric hematoma



Mesentry

- Active bleeding
- Focal hematoma
- Infiltration, Stranding
- **EXTREME** caution in observation-

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CONTRAINDICATIONS

Absolute:

Hemodynamic instability not responsive or transiently responsive to fluid resuscitation (sometimes defined as systolic blood pressure < 90 mmHg after 2 liters of intravenous fluid). CT would delay life-saving care. Emergent laparotomy or thoracotomy is needed

Relative:

Pneumoperitoneum on radiograph: Air may result from perforated hollow viscera but can also be introduced into the abdominal cavity through wound track or from pneumothorax migrating through a diaphragmatic defect

Peritonitis: Subjective sign. May be masked or mimicked by severe pain. Classically from hollow visceral perforation but can sometimes result from solid organ injuries

Hematuria: May indicate surgical renal injury or ureteral injury. However, many renal injuries that can be managed nonoperatively may still present with hematuria. CT is often used for grading penetrating renal injuries

Hematochezia: Usually indicative of hollow visceral injury requiring laparotomy; however, hematochezia may result from extraperitoneal rectal injury, which can be treated laparoscopically in select cases. Preoperative CT can often be used to distinguish between extra- and intraperitoneal rectal injury

Hematemesis: If the patient is hemodynamically stable, CT may occasionally be used to determine injuries before surgical intervention

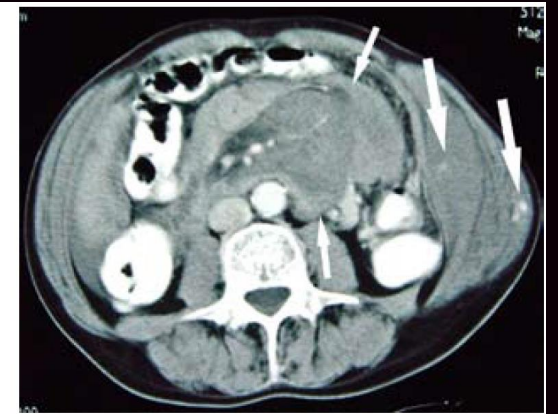
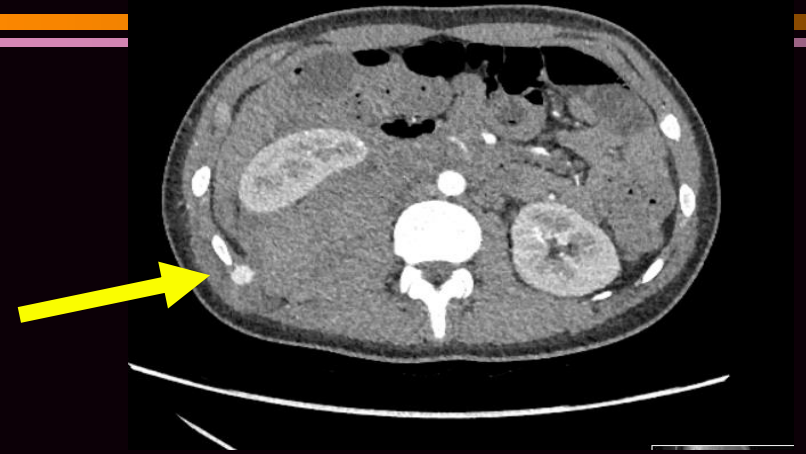
CTA?

- Exsanguinating? Expanding Haematoma? >>>>> Operation
- Otherwise CTA



Take home CAVE

- Pseudoaneurysms
- Mesentery
- Bowel



W



2023 GLOBAL PEACE INDEX

A SNAPSHOT OF THE
GLOBAL STATE OF PEACE

THE STATE OF PEACE

