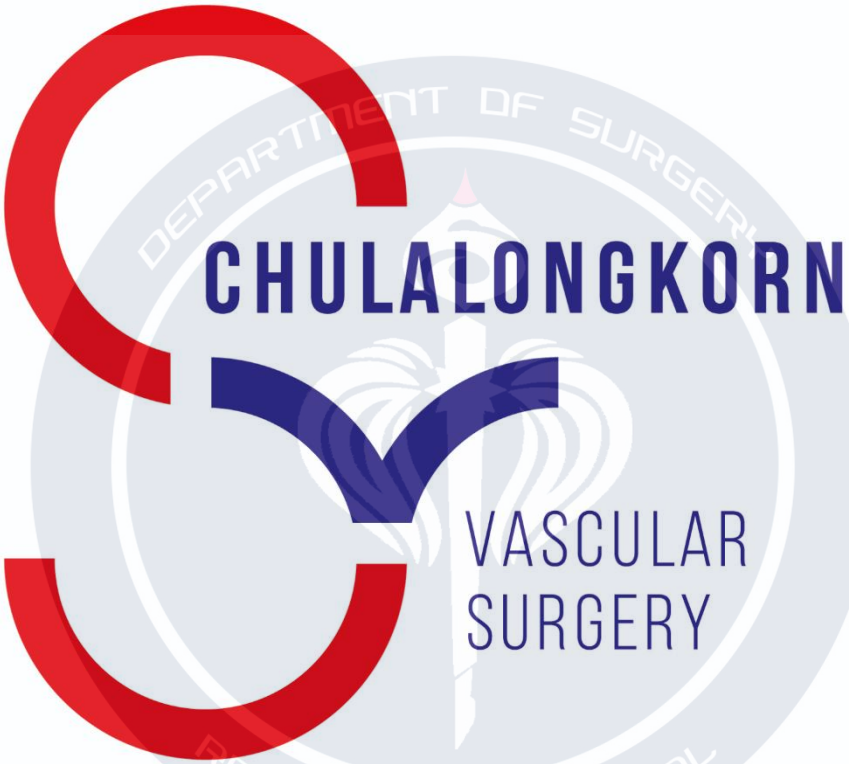

Kritaya Kritayakirana
Apinan Uthaipaisanwong
Punthita Aimsupanimitr
Natawat Narueponjirakul
Sirinya Panya

Vascular trauma- what should we know as Vascular surgeon!

Kritaya Kritayakirana
Apinan Uthaipaisanwong
Punthita Aimsupanimitr
Natawat Narueponjirakul
Sirinya Panya

Kritaya Kritayakirana, MD FACS

Associate Professor

Chulalongkorn University

June 11th 2024

Disclosure

CU Trauma team

CHULALONGKORN VASCULAR SURGERY

High quality fluoroscopy and angiographic equipment is essential.


MAQUET
Department of Surgery
Rajathibodi Hospital


SIEMENS
Healthineers


MAQUET
SIEMENS
Healthineers
ARTIS pheno

ar trauma: Kritavakirana,MD. (11/06/24)

Just do it!


PHILIPS


ALM


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Vascular injury

- Peripheral vascular injury
- Neck injury
- Thoracic vascular injury
- Abdominal vascular injury
- Pelvic vascular injury
- Intraoperative iatrogenic vascular injury

ATLS

The lower extremity evaluation should be structured to assess the four functional components of the extremity (nerves, vessels, bones, soft tissues). Injury to three of these four elements constitutes a "mangled extremity."

American Association for the Surgery of Trauma–World Society of Emergency Surgery guidelines on diagnosis and management of peripheral vascular injuries

**Leslie Kobayashi, MD, Raul Coimbra, MD, PhD, FACS, Adenauer M. O. Goes, Jr., MD, PhD, Viktor Reva, MD, Jarrett Santorelli, MD, Ernest E. Moore, MD, Joseph Galante, MD, Fikri Abu-Zidan, MD, Andrew B. Peitzman, MD, Carlos Ordonez, MD, Ronald V. Maier, MD, Salomone Di Saverio, MD, Rao Ivatury, MD, Nicola De Angelis, MD, Thomas Scalea, MD, Fausto Catena, MD, Andrew Kirkpatrick, MD, Vladimir Khokha, MD, Neil Parry, MD, Ian Civil, BSc, MBChB, Ari Leppaniemi, MD, Mircea Chirica, MD, Emmanouil Pikoulis, MD, Gustavo P. Fraga, MD, Massimo Chiarugi, MD, Dimitrios Damaskos, MD, Enrico Cicuttin, MD, Marco Ceresoli, MD, Belinda De Simone, MD, Felipe Vega-Rivera, MD, Massimo Sartelli, MD, Walt Biffl, MD, Luca Ansaloni, MD, Dieter G. Weber, MBBS, *and* Federico Coccolini, MD, *Moreno Valley, California*

Kobayashi L, Coimbra R, Goes AMO Jr, et al. American Association for the Surgery of Trauma-World Society of Emergency Surgery guidelines on diagnosis and management of peripheral vascular injuries. J Trauma Acute Care Surg. 2020 Dec;89(6):1183-1196.

Mechanism

- Blunt
- Penetrating
- Blast
- Crush
- Iatrogenic
- Radiation

Clinical Presentation and Diagnosis of PVI

TABLE 3. Clinical Signs of PVI

Hard Signs	Soft Signs
Pulsatile bleeding	Nonpulsatile bleeding
Expanding/pulsating hematoma	Nonexpanding/nonpulsatile hematoma
Loss of distal pulses	Diminished pulse
Bruit/thrill	History of arterial (massive) bleeding/hypotension
	Previously applied tourniquet
	Neurologic deficit
	Wound in proximity to named vessel

Clinical Presentation and Diagnosis of PVI

Patients with hard signs of PVI should be transported directly to the operating room for surgical exploration. Where available, patients with multilevel penetrating injuries and those with blunt PVI may benefit from use of a hybrid operating room with the ability to perform on table angiography for both diagnostic and therapeutic purposes. When not available, C-arm can be used for on-table angiography to augment surgical exploration and repair. (GoR 1B)

Clinical Presentation and Diagnosis of PVI

Presence of peripheral pulses alone cannot reliably exclude AI. For hemodynamically stable patients with concerning mechanism, proximity injury, or soft signs of PVI, additional evaluation with ankle brachial index (ABI) or arterial pressure index (API) measurements is required. (GoR 1B)

Clinical Presentation and Diagnosis of PVI

Ankle brachial index and API are effective screening methods for detecting major AI; an ABI/API of >0.9 generally excludes the need for additional imaging. (GoR 1B)

Clinical Presentation and Diagnosis of PVI

Patients with knee dislocations are at higher risk of occult popliteal artery injury. Normal distal pulse upon PEX does not exclude popliteal artery injury. Additional imaging including formal or computed tomography angiography (CTA) may be beneficial. (GoR 2B)

Clinical Presentation and Diagnosis of PVI

Computed tomography angiography is recommended as the first-line modality for investigating blunt and penetrating PVIs in adults and children who are hemodynamically stable without active bleeding. (GoR 1B)

Clinical Presentation and Diagnosis of PVI

Invasive catheter angiography should be reserved for patients in need of interventional procedures, if vasospasm is clinically suspected or when CTA is unavailable, equivocal, or nondiagnostic due to artifact from retained metallic objects.

(GoR 1B)

Clinical Presentation and Diagnosis of PVI

Patients with penetrating extremity trauma (having no other injuries) who present with normal PEX and normal ABI/API may be safely discharged (GoR 1B). These patients, however, should be followed up in an outpatient setting because of the risk of delayed PSA.

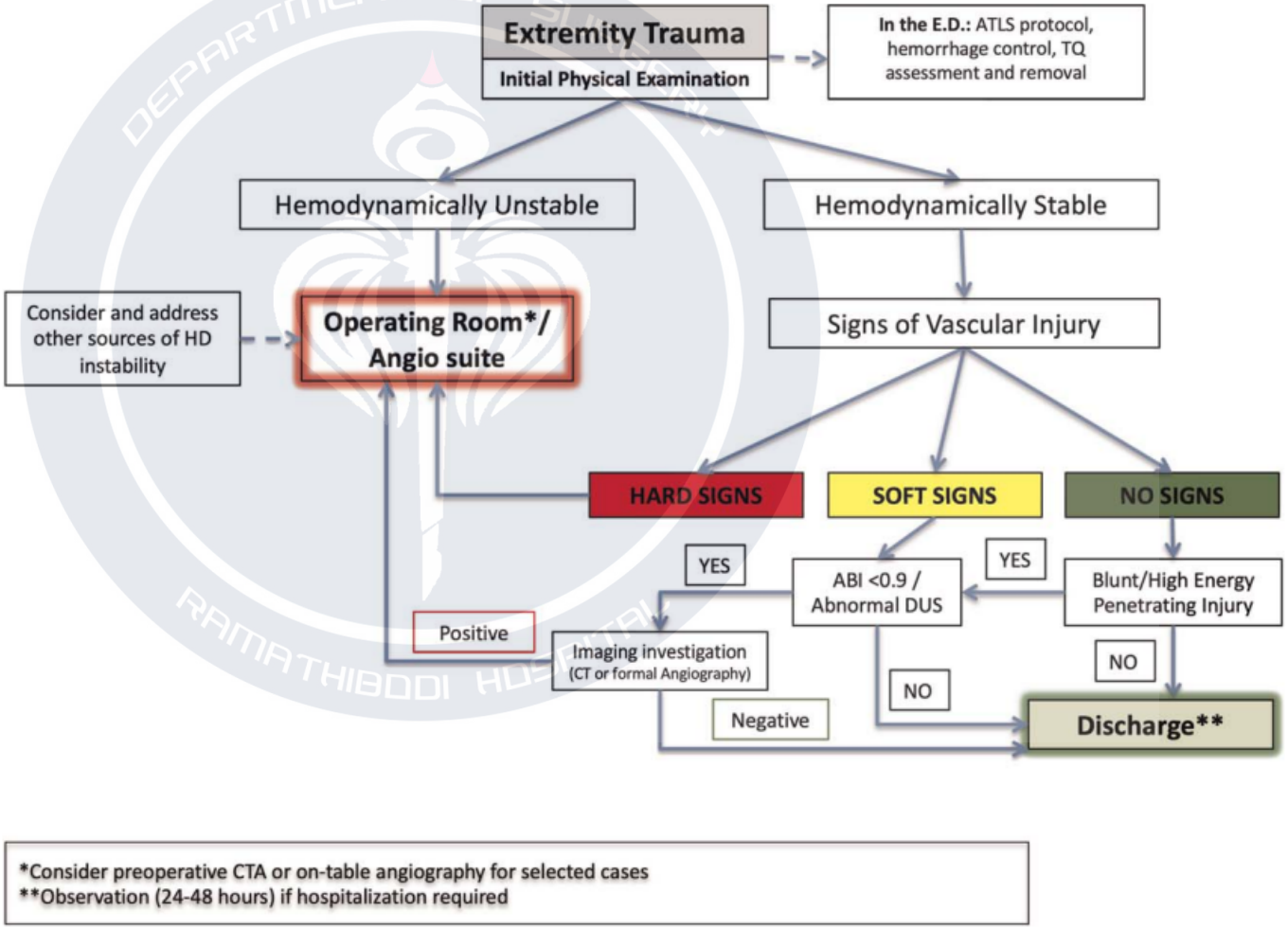

Figure 1. Peripheral vascular injury diagnostic and management algorithm.


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Treatment of PVI

- Nonoperative management (NOM) can be considered in selected stable patients with AAST Grades I and II injuries with out active hemorrhage or signs of distal ischemia. (GoR 2C)
- NOM can also be considered for isolated AAST Grade III tibial and peroneal injuries where either the anterior or posterior tibial artery remains intact and there is no active hemorrhage or distal ischemia. (GoR 2C)

Treatment of PVI

- In the presence of external hemorrhage, the use of direct pressure and tourniquets is recommended in the prehospital setting. (GoR 1C)

Treatment of PVI

Vascular Damage Control

Vascular damage control describes a complement of early temporizing maneuvers short of definitive reconstruction performed with the intent of maximizing life and limb salvage in patients with anatomically complex and physiologically significant injuries. These maneuvers present considerations unique to the treatment of patients with vascular trauma. Considerations for operative planning are presented in Table 183.3 .

Rutherford's 10th ed chapter 183 page 2434

Treatment of PVI

The general principles of establishing proximal and distal vascular control and restoring in-line flow to a suitable outflow bed are the same for the treatment of traumatic lesions as for any other vascular defect. Because traumatic vascular injuries frequently present with significant hemorrhage, the ability to expeditiously achieve vascular control is paramount. To ensure adequate exposure for control and repair, longitudinal or extensile anatomic exposures are preferred. Once vascular control is achieved, incisions can be extended as needed to expose the zone of vascular injury. Upper extremity control may require infraclavicular or supraclavicular incisions to expose the subclavian vessels. Retroperitoneal or inguinal ligament–splitting incisions may be required for proximal control in the lower extremity. If feasible, endovascular balloon control may reduce morbidity in such cases. Many trauma patients may be unable to tolerate systemic anticoagulation because of ongoing hemorrhage or associated injuries. In these patients, local anticoagulation with heparinized saline injection directly into the injured vessel proximal and distal to the injury may be employed. [99]

Rutherford's 10th ed chapter 183 page 2437

Treatment of PVI

- Isolated radial or ulnar AIs without evidence of distal ischemia can be managed with simple ligation. (GoR 2C

Treatment of PVI

- Isolated infrageniculate AI where either the anterior or posterior tibial artery is intact and there is no distal ischemia can be managed with simple ligation, unless there is extensive soft tissue injury. (GoR 2C)

Treatment of PVI

- Proximal and distal thrombectomy should be done with a Fogarty catheter for major AIs, and the proximal and distal segments should be flushed with heparinized saline. (GoR 1B)

Treatment of PVI

- For AAST Grades IV and V injuries, tension-free end-to-end primary repair is the procedure of choice. (GoR 1C)

Treatment of PVI

- Where primary repair is not technically possible, resection and interposition graft should be performed. When performing arterial reconstruction, autologous saphenous vein is the conduit of choice. (GoR 1C)

Treatment of PVI

- For complex injuries and injuries with significant ischemic time, and in damage-control situations, intravascular shunts should be used to rapidly restore perfusion and bridge to definitive repair. (GoR 2C)

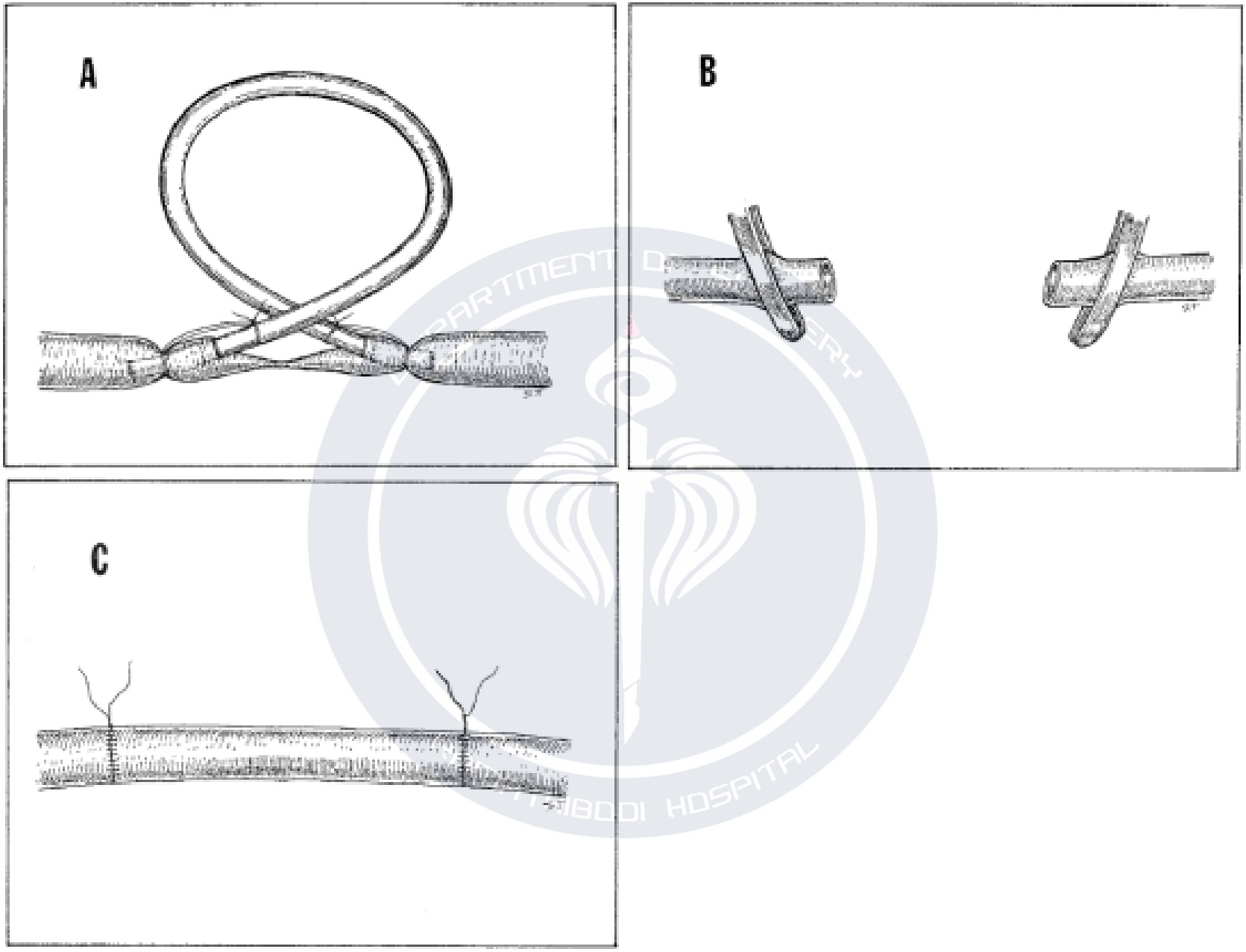
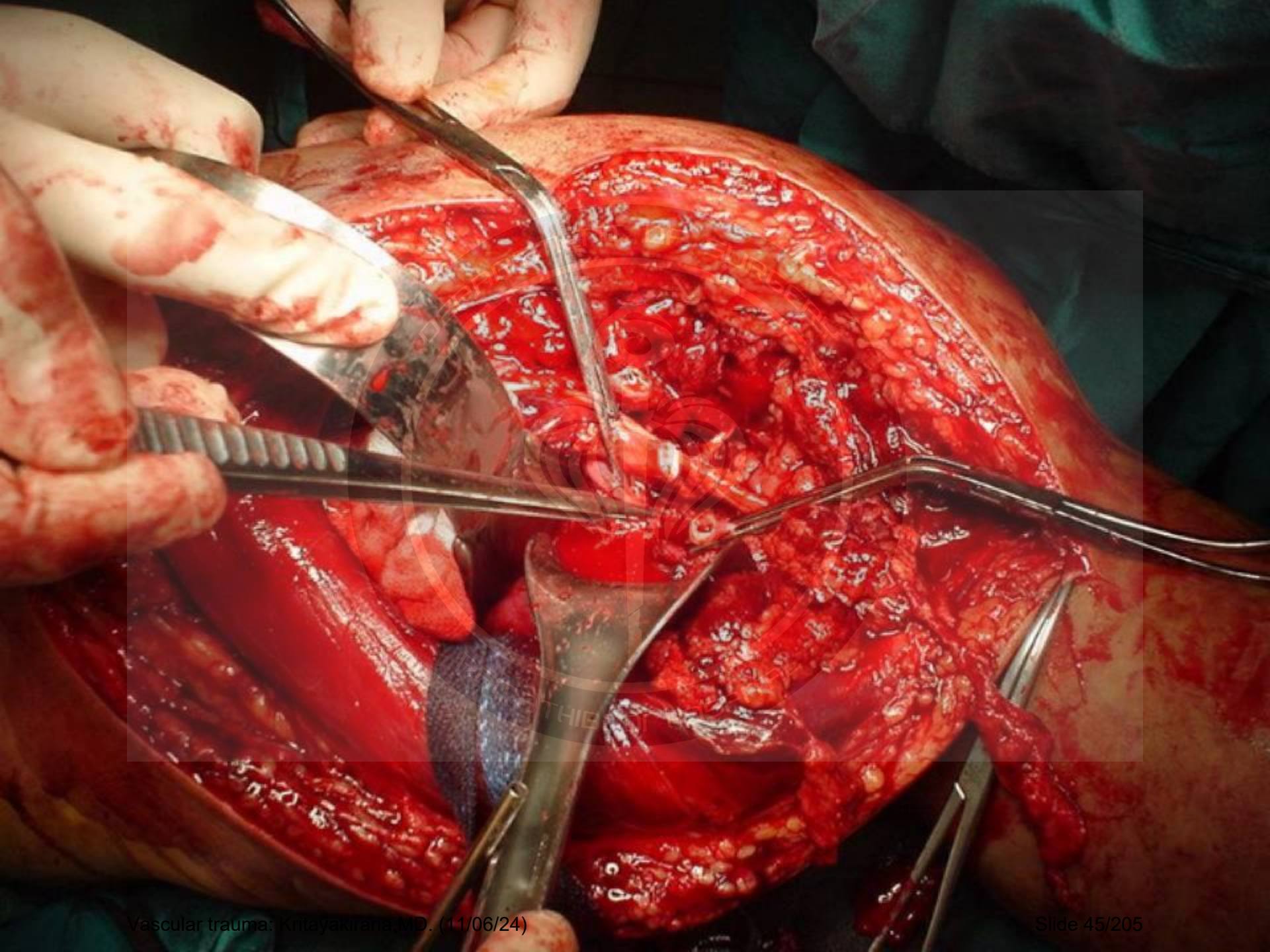
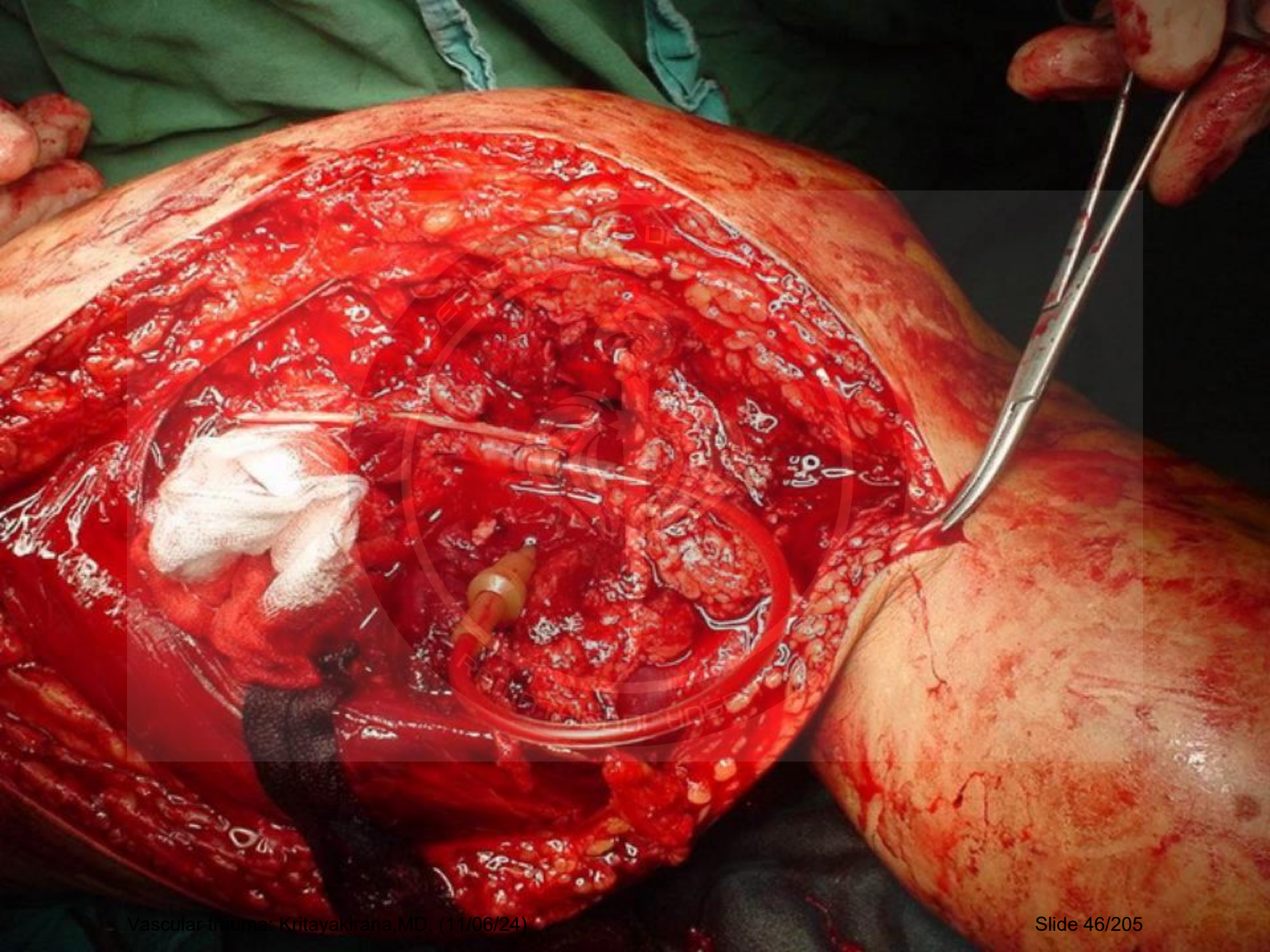


Fig. 2. *Schematic drawings show major steps of arterial repair when a temporary intravascular shunt is used. (A) The shunt is in place in an injured artery. (B) The injured arterial segment is resected to obtain good proximal and distal arterial ends. (C) Interposition grafting is performed by using a segment of reversed saphenous vein.*






สภากาชาดไทย
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สภากาชาดไทย

Treatment of PVI

- Peripheral venous injuries should be repaired, if possible, to reduce the risk of amputation and venous insufficiency. (GoR 2C)

Treatment of PVI

- In unstable patients and in those with destructive venous injuries not amenable to repair, ligation of peripheral veins is acceptable, but prophylactic fasciotomy or serial monitoring of compartment pressures should be considered particularly in combined arteriovenous injuries because of the high risk for compartment syndrome. (GoR 2C)

Treatment of PVI

- Primary amputation may be considered in the unstable patient with a mangled extremity (Mangled Extremity Severity Score [MESS], >7) if presentation is significantly delayed (i.e., prolonged ischemic time with no sensation or motor activity) and in injuries with irreparable soft tissue damage leading to a functionally nonviable extremity. Optimally, this decision should be made by a multidisciplinary team. (GoR 2C)

Treatment of PVI

- Endovascular repair may be considered in the management of peripheral PSAs, AVF, and other small vessel injuries diagnosed on CTA without hard signs of vascular injury. (GoR 2C)

Treatment of PVI

- There is no evidence to support the use of systemic intraoperative heparinization or postoperative antiplatelet agents or anticoagulation after most vascular repairs. The exception is prolonged ischemic time with small vessel occlusions. (GoR 2C)

Fox N, Rajani RR, Bokhari F, et al. Evaluation and management of penetrating lower extremity arterial trauma: an Eastern Association for the Surgery of Trauma practice management guideline. J Trauma Acute Care Surg. 2012 Nov;73 (5 Suppl 4):S315-20.

- The time interval between injury and evaluation must be considered.
- More than 6 hours of “warm” ischemia at body temperature with out cooling the extremity results in irreversible nerve and muscle damage in 10% of patients

Level 3

- In cases of hemorrhage from penetrating lower extremity trauma in which manual compression is unsuccessful, tourniquets may be used as a temporary adjunct for hemorrhage control until definitive repair.

Level 3

- The use of temporary intravascular shunts (TIVSs) may be indicated to restore arterial flow in combined vascular/ orthopedic injuries (Gustillo IIIC fractures) to facilitate limb perfusion during orthopedic stabilization.

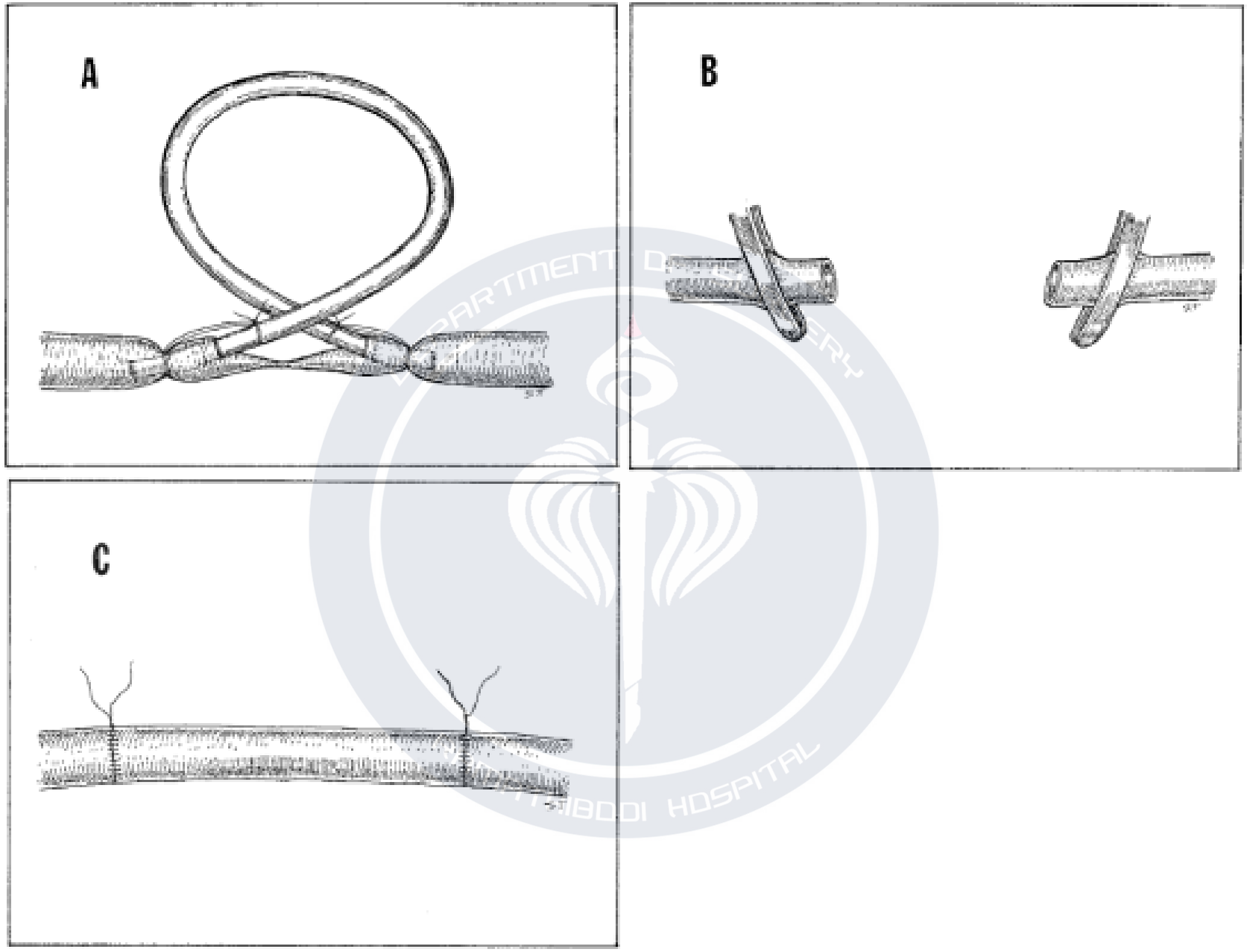
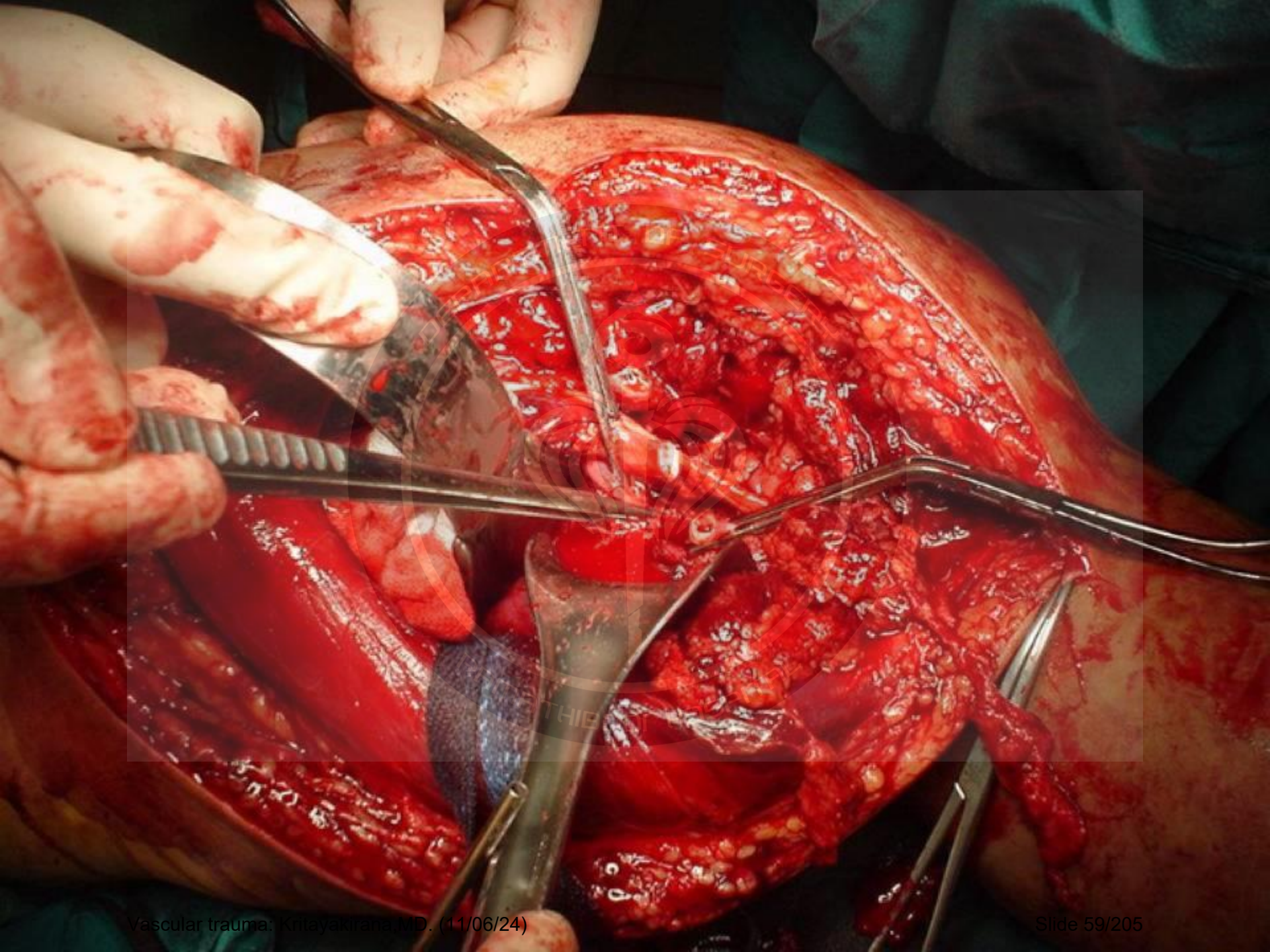
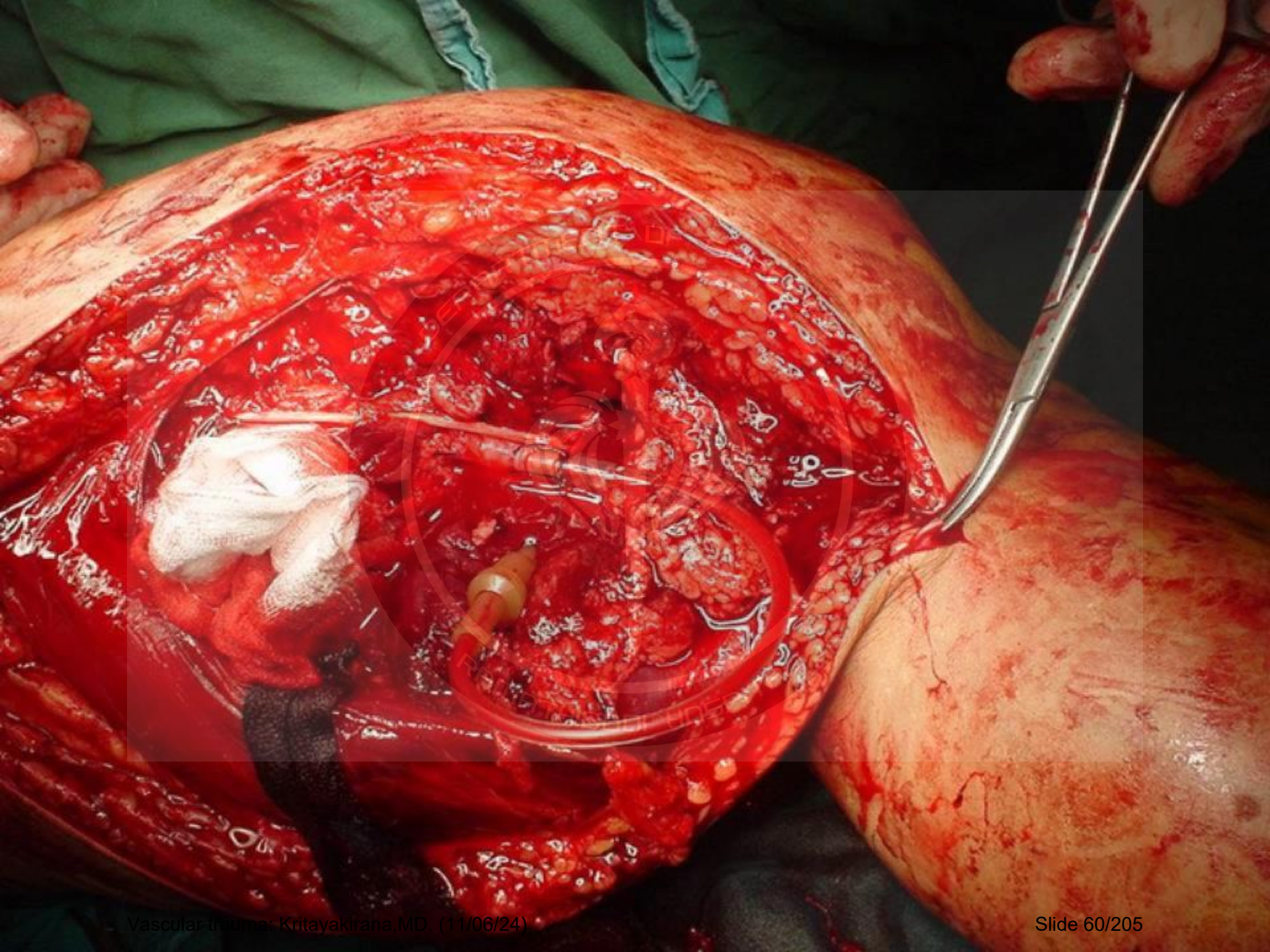


Fig. 2. *Schematic drawings show major steps of arterial repair when a temporary intravascular shunt is used. (A) The shunt is in place in an injured artery. (B) The injured arterial segment is resected to obtain good proximal and distal arterial ends. (C) Interposition grafting is performed by using a segment of reversed saphenous vein.*





Level 3

- TIVSs may be indicated in "damage control" situations to facilitate limb perfusion when the physiologic status of the patient or operative capabilities prevent definitive repair.

Level 3

- There are no data to support the routine use of endovascular therapies following **infrainguinal** trauma.

Level 3

- Simple arterial repairs fare better than grafts. If complex repair is required, vein grafts seem to be the best choice. PTFE, however, is also an acceptable conduit (2002).

Level 3

- PTFE may be used in a contaminated field. Effort should be made to obtain soft tissue coverage (2002).

Level 3

- Early four-compartment lower leg fasciotomy should be applied liberally when there is an associated injury or there has been prolonged ischemia. If not performed, compartment pressures should be closely monitored (2002)

Level 3

- Completion arteriogram should be performed after arterial repair (2002)

- The priorities of vascular injury are arrest of hemorrhage and restoration of normal circulation.

Evaluation and management of blunt traumatic aortic injury: A practice management guideline from the Eastern Association for the Surgery of Trauma

Nicole Fox, MD, Diane Schwartz, MD, Jose H. Salazar, MD, Elliott R. Haut, MD, Philipp Dahm, MD, James H. Black, MD, Scott C. Brakenridge, MD, John J. Como, MD, Kimberly Hendershot, MD, David R. King, MD, Adrian A. Maung, MD, Matthew L. Moorman, MD, Kimberly Nagy, MD, Laura B. Petrey, MD, Ronald Tesoriero, MD, Thomas M. Scalea, MD, *and* Timothy C. Fabian, MD

BACKGROUND: Blunt traumatic aortic injury (BTAI) is the second most common cause of death in trauma patients. Eighty percent of patients with BTAI will die before reaching a trauma center. The issues of how to diagnose, treat, and manage BTAI were first addressed by the Eastern Association for the Surgery of Trauma (EAST) in the practice management guidelines on this topic published in 2000. Since that time, there have been advances in the management of BTAI. As a result, the EAST guidelines committee decided to develop updated guidelines for this topic using the Grading of Recommendations, Assessment, Development and Evaluation (GRADE) framework recently adopted by EAST.

METHODS: A systematic review of the MEDLINE database using PubMed was performed. The search retrieved English language articles regarding BTAI from 1998 to 2013. Letters to the editor, case reports, book chapters, and review articles were excluded. Topics of investigation included imaging to diagnose BTAI, type of operative repair, and timing of operative repair.

RESULTS: Sixty articles were identified. Of these, 51 articles were selected to construct the guidelines.

CONCLUSION: There have been changes in practice since the publication of the previous guidelines in 2000. Computed tomography of the chest with intravenous contrast is strongly recommended to diagnose clinically significant BTAI. Endovascular repair is strongly recommended for

J Trauma Acute Care Surg. 2015 Jan;78(1):136-46.

Population Intervention Comparator Outcome

- In patients with suspected BTAI (P), should CT of the chest with intravenous contrast (I) be used versus conventional catheter-based angiography (C) for the identification of clinically significant BTAI (O)?

Population Intervention Comparator Outcome

- In patients with BTAI (P), should endovascular (I) repair be performed versus open repair (C) to minimize risk of mortality, stroke, paraplegia, and renal failure (O)?

Population Intervention Comparator Outcome

- In patients with BTAI (P), should timing of repair be delayed (I) or immediate (C) to minimize risk of mortality, stroke, paraplegia, and renal failure (O)?

What would you do?

A 46 Year old male patient involved in a Motor cycle accident

What would you do?

Upon arrival at out side hospital

V/S BP 80/60 PR 127/min

GCS E3M5V4

What would you do?

Primary and Secondary survey found

- Bilateral hemopneumothorax
- Left intracerebral hemorrhage
- Thoracic Aortic Injuries
- Open fracture left tibia
- Open fracture both bone left forearm

What would you do?

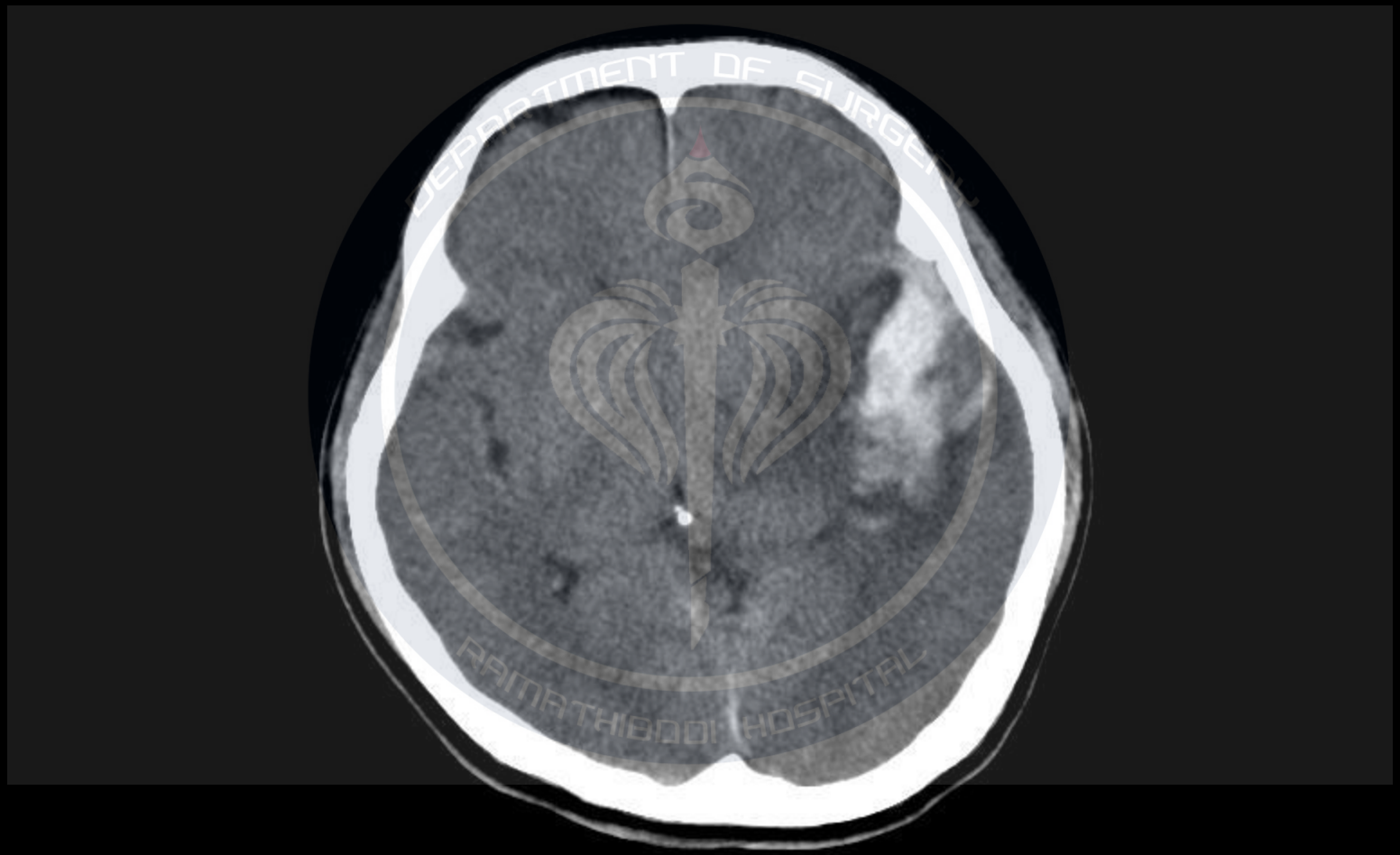
- Endotrachel intubation with C spine protection
- Bilateral intercostal chest drains
- Warm ringer lactate
- Pack Red cell
  - Hct41% 18% 33%

What would you do?

What would you do?

Transfer to King Chulalongkorn Memorial Hospital

- At KCMH
  - BP 202/97 mmHg
  - PR 90/min
  - GCS E2M5VT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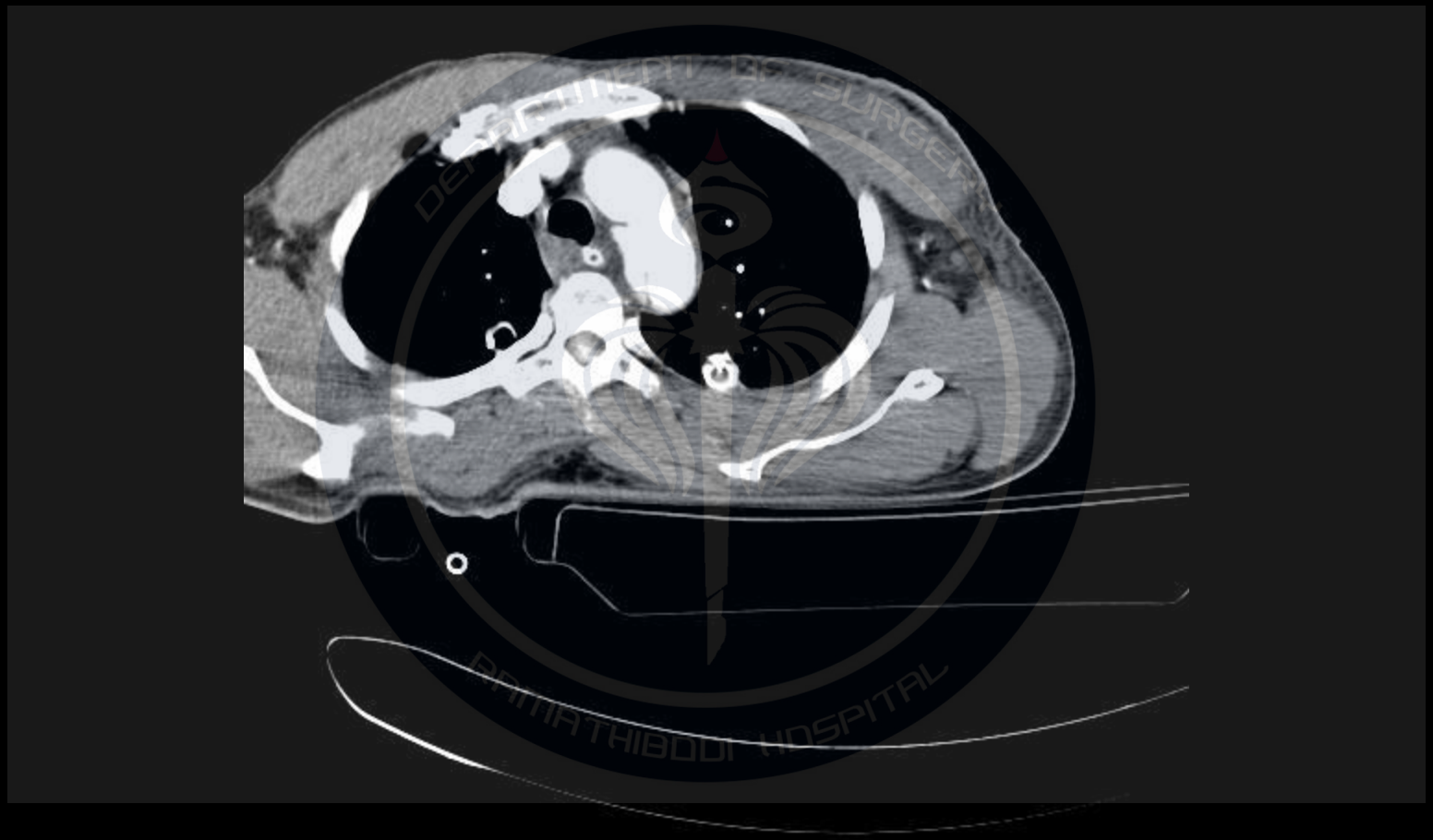
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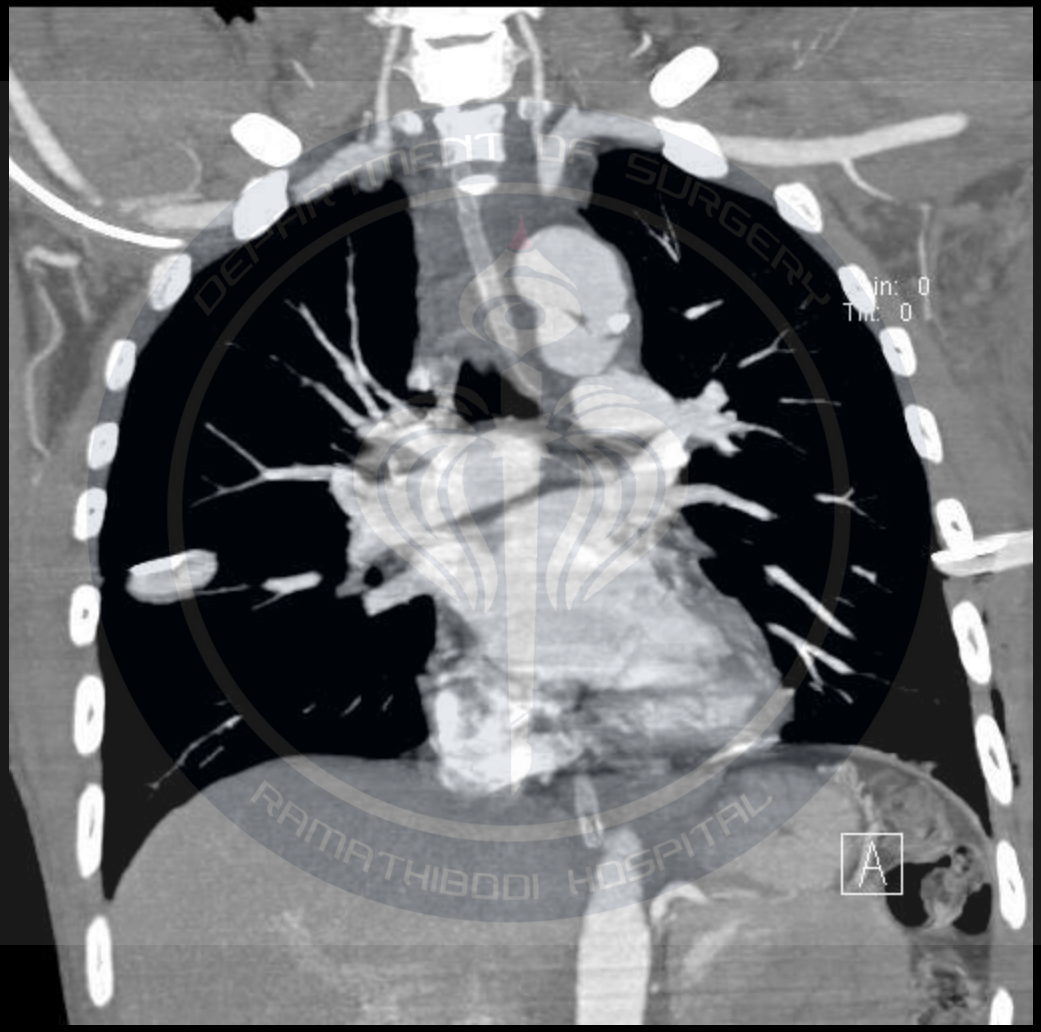
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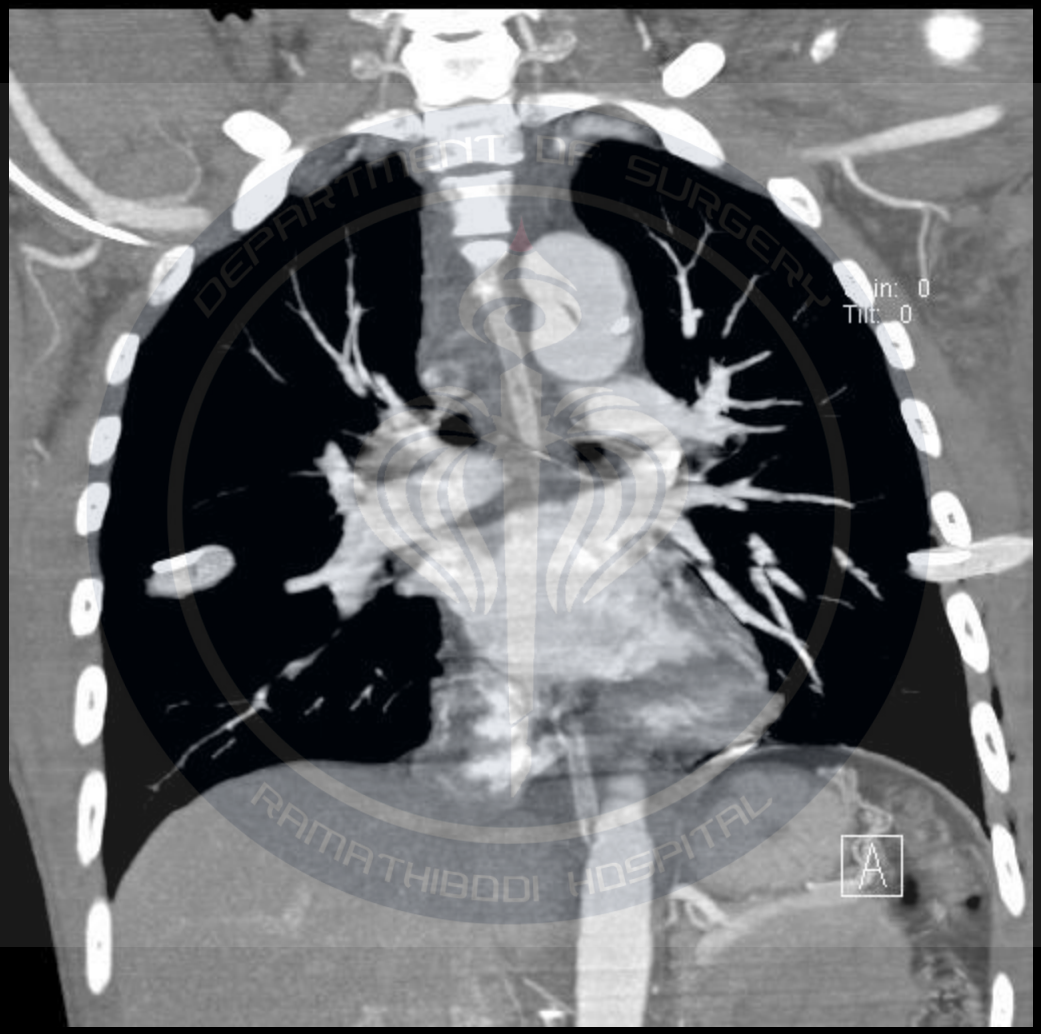
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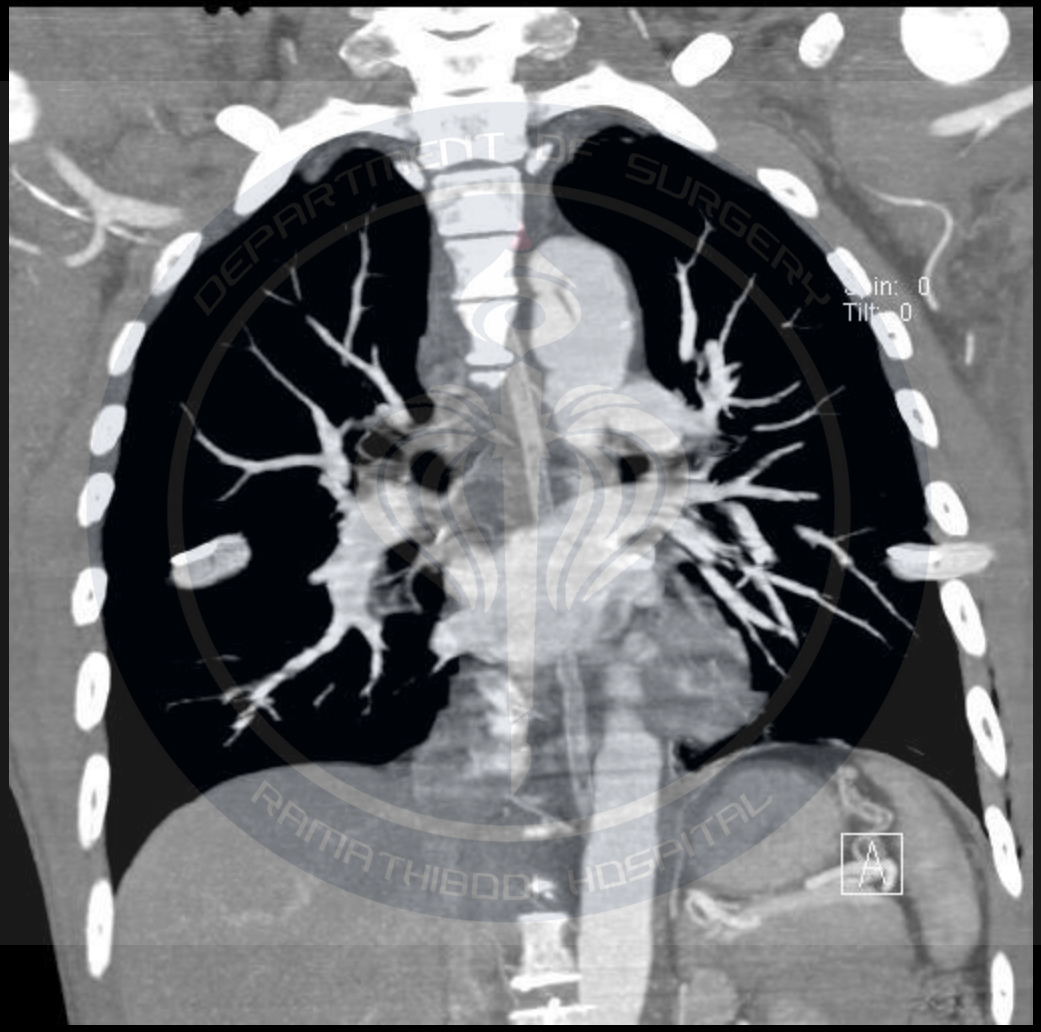
Spin: 0
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Spin: 0
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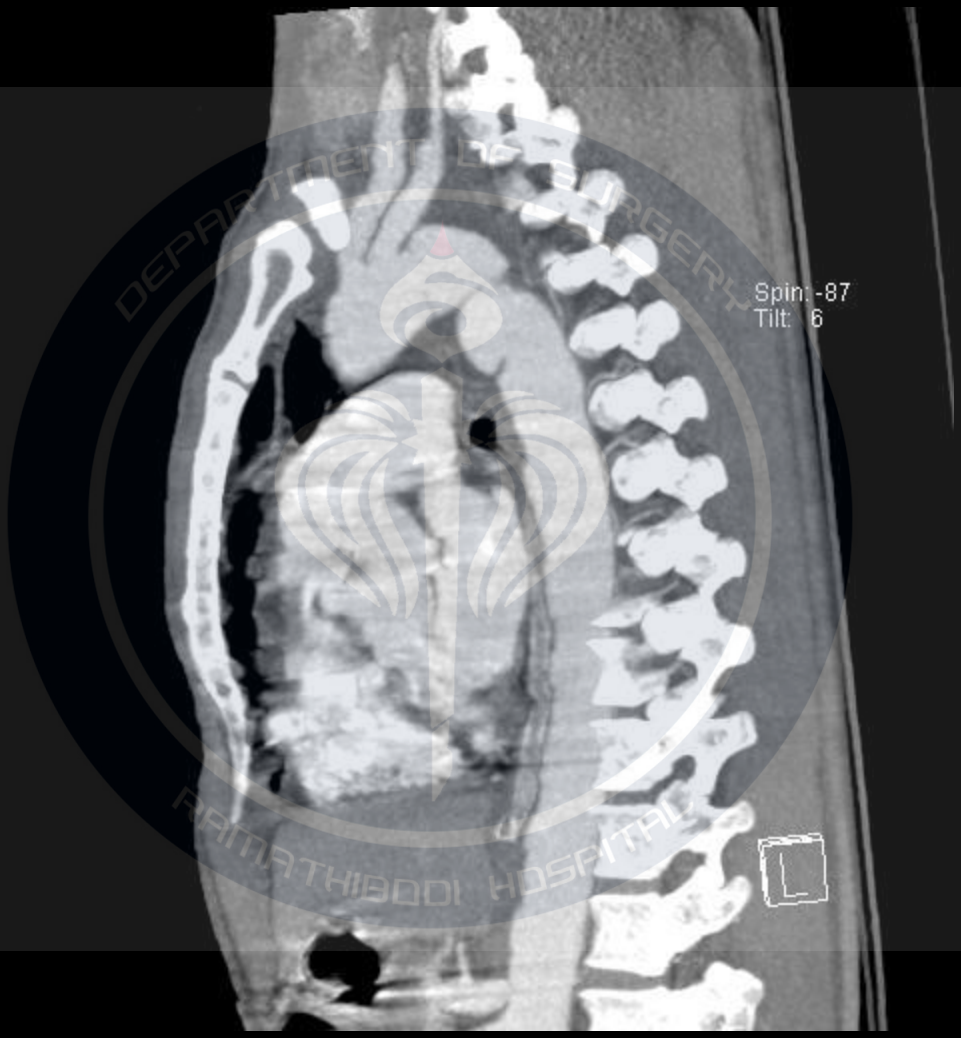
Spin: -87
Tilt: 6


Spin: -87
Tilt: 6


Spin: -87
Tilt: 6
L


Spin: -45
Tilt: 4
A
L

What would you do?

History

- Vaselius : first report of death from aortic injury in 1557
- 1954 DeBakey

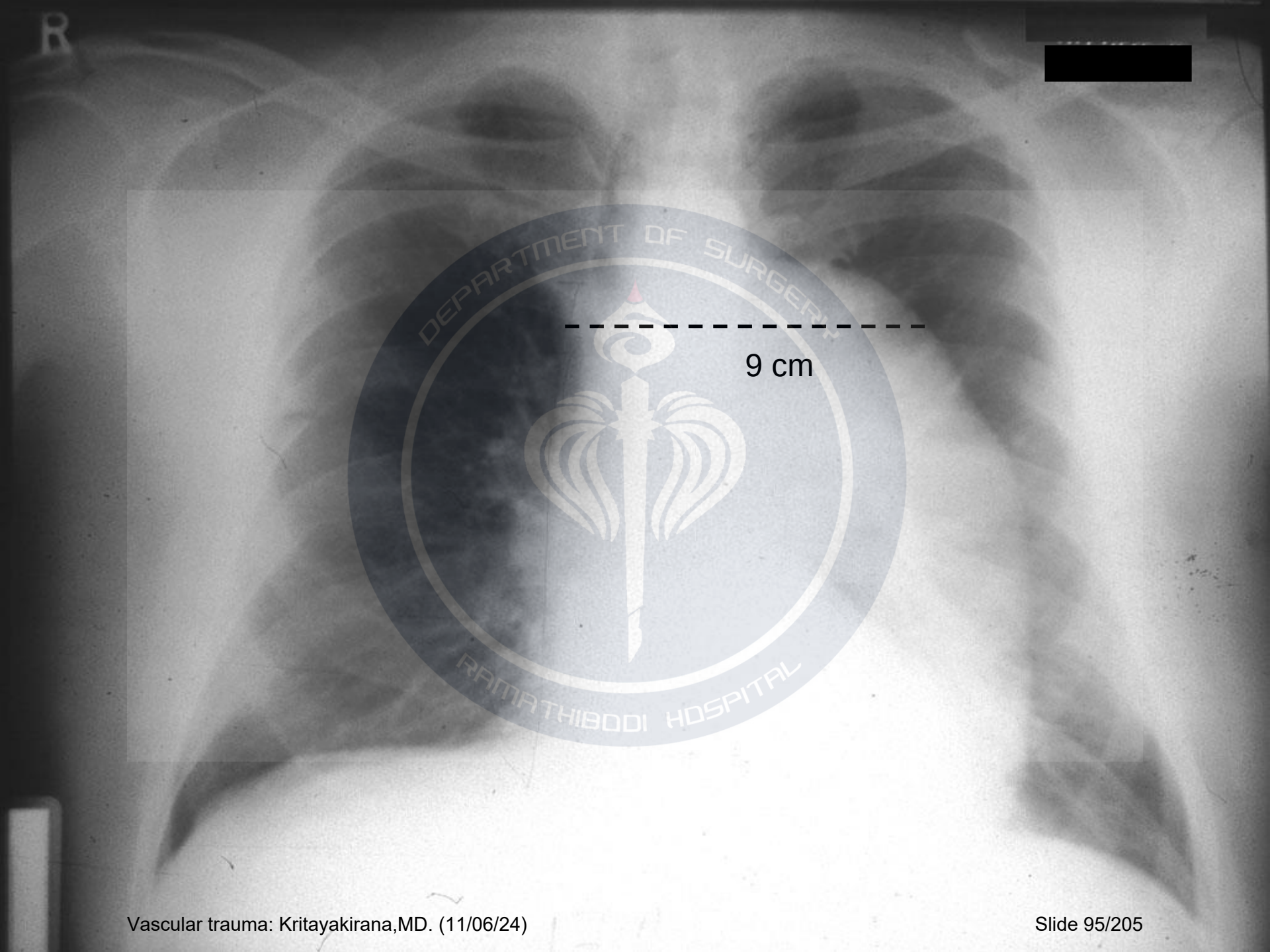
- Michael DeBakey passed away July 11, 2008
- Invented heart lung machine
- Operated more than 5000 patients

Natural history

- Parmley et al : 1958
  - 86% : death at accident scene or within 30 minute of hospital arrival
  - In hospital
    - 20% : death in 6 hr.
    - 30% : death in 24 hr.
    - 85% : death in 8 days
    - Only 2% : survive without treatment, but develop chronic pseudoaneurysm

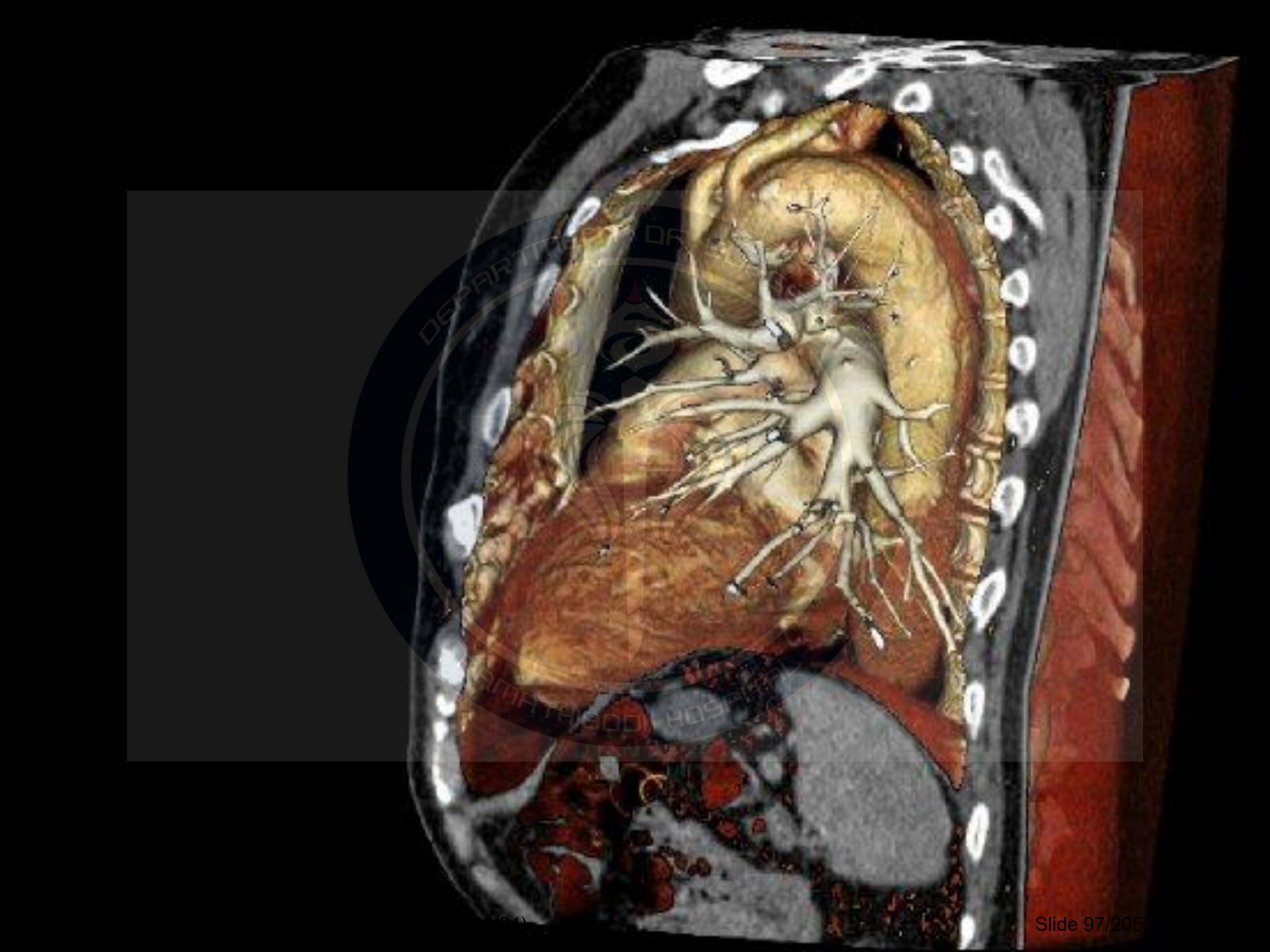
TABLE 1. *Initial Chest Radiograph Findings in 259 Patients with Blunt Aortic Injury*[2]

Wide mediastinum	221 (85%)
Indistinct aortic knob	63 (24%)
Left pleural effusion	49 (19%)
Apical cap	49 (19%)
First and/or second rib fracture	33 (13%)
Tracheal deviation	32 (12%)
Depressed left bronchus	12 (5%)
Nasogastric tube deviation	29 (11%)
Negative radiograph	19 (7%)


9 cm

CT Scan

- Contrast-enhanced CT using multidetector-row technology : MDCT
- Advantages of MDCT to aortogram
  - Take less time
  - Always available
  - Cost effective
  - Can use for stent graft sizing



CT Scan

- Direct signs of aortic injury
  - Active extravasation of contrast
  - Pseudoaneurysm formation
  - Intimal flaps
  - Filling defects
- Indirect signs of aortic injury
  - Periaortic hematoma
  - Mediastinal hematoma

Endovascular repair of traumatic thoracic aortic injury: Clinical practice guidelines of the Society for Vascular Surgery

W. Anthony Lee, MD,[a] Jon S. Matsumura, MD,[b] R. Scott Mitchell, MD,[c] Mark A. Farber, MD,[d] Roy K. Greenberg, MD,[e] Ali Azizzadeh, MD,[f] Mohammad Hassan Murad, MD, MPH,[g] and Ronald M. Fairman, MD,[h] *Boca Raton, Fla; Madison, Wisc; Palo Alto, Calif; Chapel Hill, NC; Cleveland, Ohio; Houston, Tex; Rochester, Minn; and Philadelphia, Pa*

The Society for Vascular Surgery® pursued development of clinical practice guidelines for the management of traumatic thoracic aortic injuries with thoracic endovascular aortic repair. In formulating clinical practice guidelines, the Society selected a panel of experts and conducted a systematic review and meta-analysis of the literature. They used the Grading of Recommendations Assessment, Development and Evaluation methods (GRADE) to develop and present their recommendations. The systematic review included 7768 patients from 139 studies. The mortality rate was significantly lower in patients who underwent endovascular repair, followed by open repair, and nonoperative management (9%, 19%, and 46%, respectively, $P < .01$). Based on the overall very low quality of evidence, the committee suggests that endovascular repair of thoracic aortic transection is associated with better survival and decreased risk of spinal cord ischemia, renal injury, graft, and systemic infections compared with open repair or nonoperative management (Grade 2, Level C). The committee was also surveyed on a variety of issues that were not specifically addressed by the meta-analysis. On these select matters, the majority opinions of the committee suggest urgent repair following stabilization of other injuries, observation of minimal aortic defects, selective (vs routine) revascularization in cases of left subclavian artery coverage, and that spinal drainage is not routinely required in these cases. (J Vasc Surg 2011;53:187-92.)

Blunt traumatic thoracic aortic injury is associated with a high mortality rate, and has been implicated as the second most common cause of death in trauma patients, behind only to intracranial hemorrhage.[1,2] It has been estimated that less than 25% of patients with such an injury live to be evaluated in a hospital,[3] and of those who do, up to 50% will die within 24 hours.[4] Given the location of injury in 50% to 70% of cases,[4] conventional surgical repair typically involves a high posterolateral thoracotomy with or without cardiopulmonary bypass and significant blood loss, which can negatively impact the pulmonary, cardiac, and neurologic status of the patient. Historically, open repair of traumatic aortic injuries has been associated with a 28% mortality rate[5] and a 16% paraplegia rate.[6] There has been a risk of delayed rupture in the unrepaired thoracic transection that has been estimated to be 2% to 5%.[7]

Thoracic endovascular aortic repair (TEVAR) is a rapidly evolving therapy in the treatment of a variety of thoracic aortic pathologies. TEVAR involves placing an endovascular stent graft into the thoracic aorta from a remote peripheral location under imaging guidance. TEVAR offers the potential for a durable aortic repair while avoiding the morbidity of a thoracotomy, aortic cross clamping, and cardiopulmonary bypass. Nevertheless, stroke, spinal cord ischemia, and other complications that are associated with open repair can also occur with TEVAR.

Although there is no device currently commercially available with an on-label indication for repair of traumatic thoracic aortic transections, these are increasingly being treated off-label using endovascular devices. At the time of this manuscript, there were at least two ongoing investigator device exemption (IDE) pivotal clinical trials in-

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doi:10.1016/j.jvs.2010.08.027

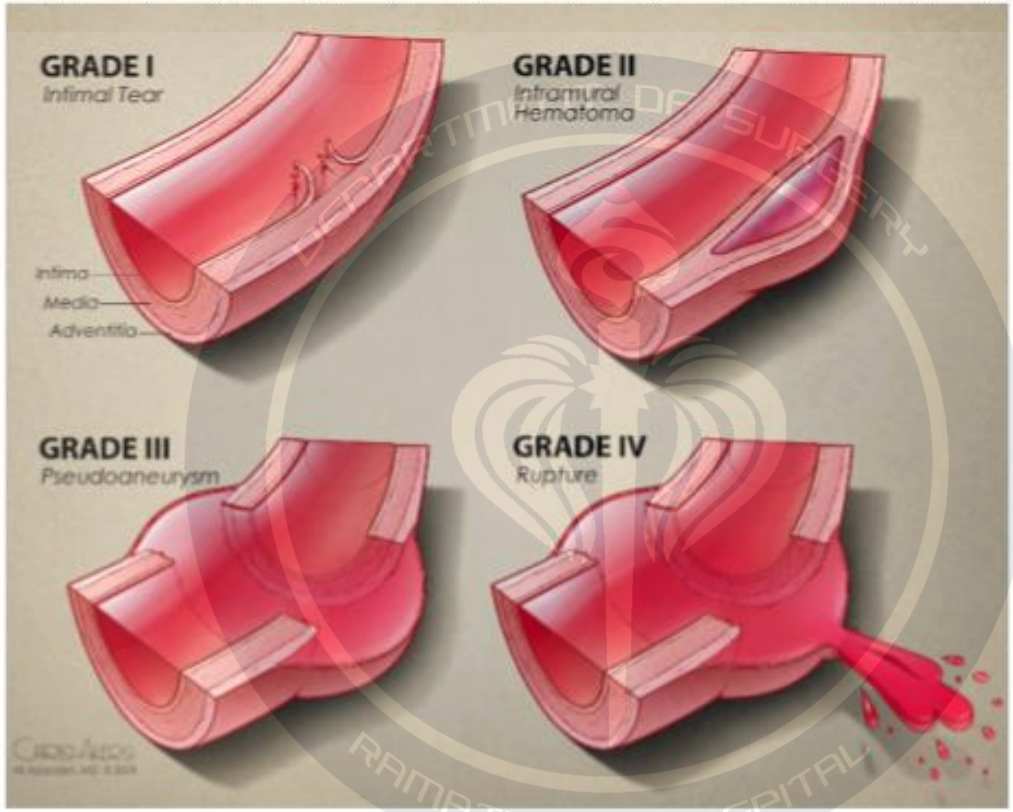


Fig. Classifications of traumatic aortic injury.[12]

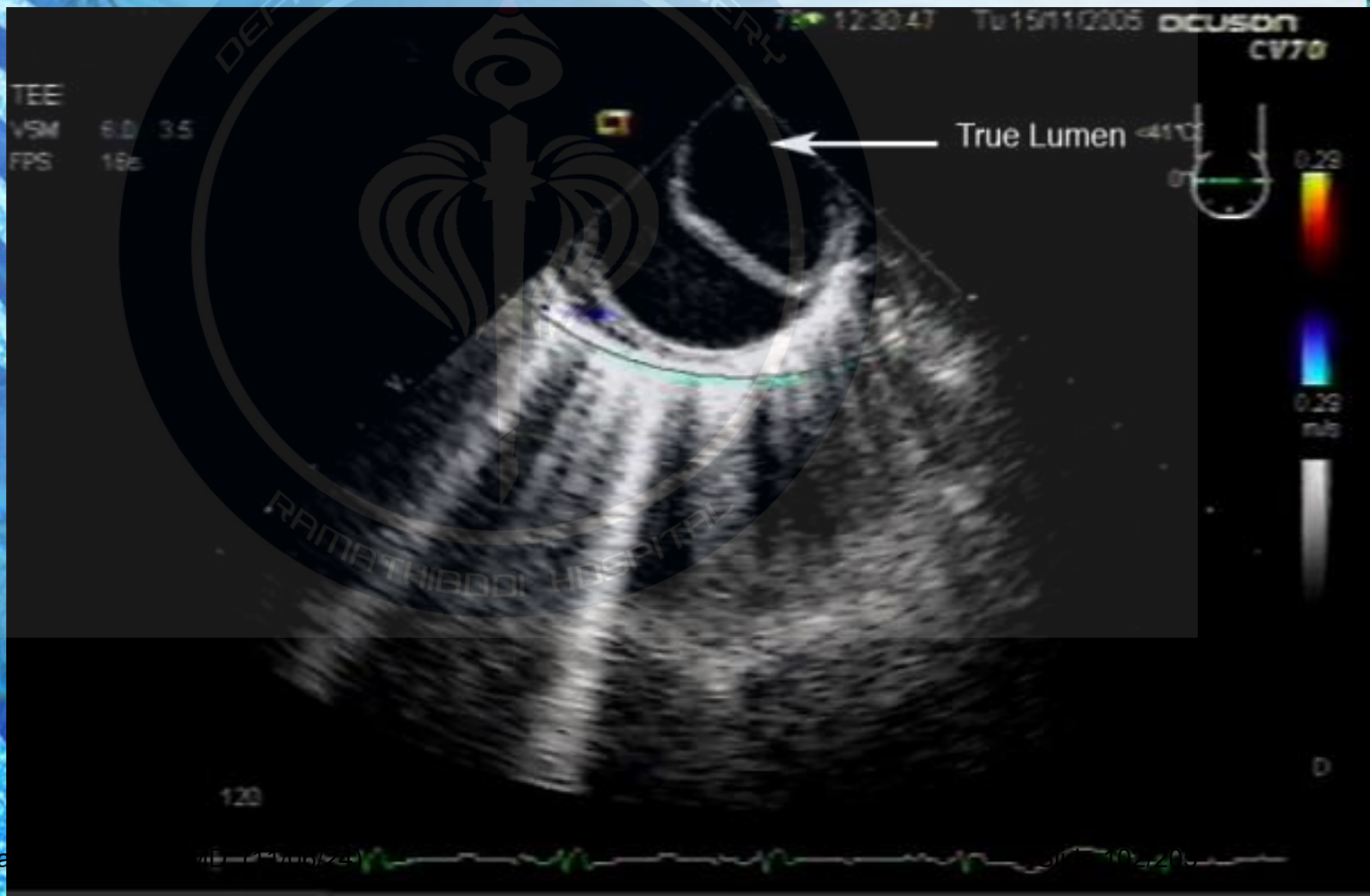
nents such as proximal extension cuffs have been used when thoracic devices were either unavailable or anatomically unsuitable.[17,18] Due to the shorter delivery systems, often these devices could not reach the site of injury from the femoral approach, which necessitated either use of a longer makeshift delivery system or access through a more proximal site. The lengths of extension cuffs are typically short, and this required multiple overlapping pieces. Such an

larization (either before or after TEVAR) depending on the status of the vertebral anatomy, with a minority opinion favoring routine revascularization.[19] In the current meta-analysis,[9] the LSA was covered in 30% of cases. Preservation of antegrade perfusion on the side of the dominant vertebral artery can specifically decrease the risk of posterior circulation strokes.[20] However, the urgency of the repair and the condition of the victim may preclude preoperative

Magnetic Resonance Imaging

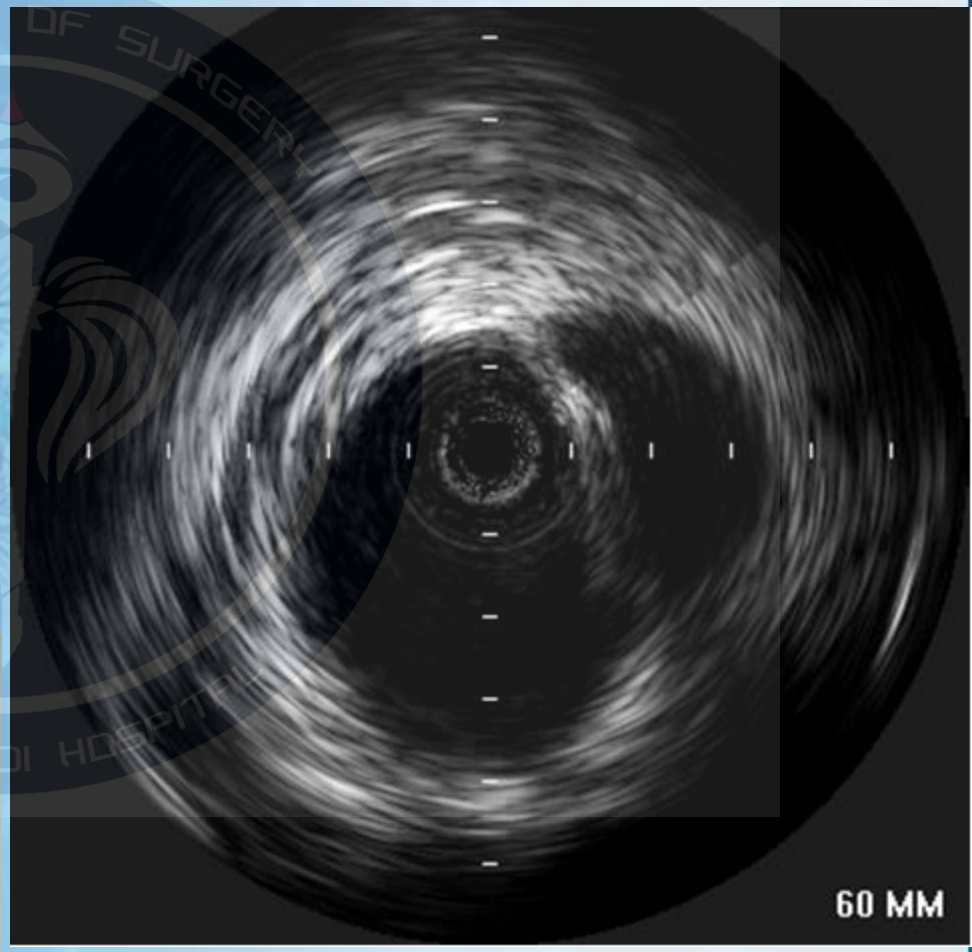
- Magnetic Resonance Angiography image quality ?
- Time consuming.
- More suitable for follow up.

Transesophageal echocardiography



Kritayakirana,MD. (11/06/24)

Intravascular ultrasound



Aortogram

- Gold standard for diagnosis
- Small incidence of false-positive : anatomic abnormalites
  - Ductus diverticulum
  - Aberrant brachiocephalic artery
- Contrast agent

•Fabian T, Richardson J, Croce M, et al. Prospective study of blunt aortic injury: multicenter trial of the American Association for the Surgery of Trauma. University of Tennesse. J Trauma 1997;42:374-83.
•Fabian T, Davis K, Gavant M, Croce M, Melton S, Patton J, Haan C, Weiman D, Pate J. Prospective Study of Blunt Aortic Injury. University of Tennessee. Ann Surg 1998;227(5):666-77.

Non operative Management

- Sever head injury
- High risk for infection
  - Major burns
  - Sepsis
  - Heavily contaminated wound
- Severe multisystem trauma with hemodynamic instability or poor physiologic reserve

Medical management

- Use of anti-hypertensives first described at MGH
  - Successful in mgt of dissecting aortic aneurysms -> reducing shearing forces

- Warren R, Akins C, Conn A, et al. Acute traumatic disruption of the thoracic aorta: emergency department management. Massachusetts General Hospital. Ann Emerg Med 1992;21:391-96.
- Maggisano R, Nathens A, Alexandrova N, et al. Traumatic rupture of the thoracic aorta: should one always operate immediately? Ann Emerg Med 1992; 21:391-96.
- Akins C, Buckley M, Daggett W, et al. Acute traumatic disruption of the thoracic aorta: a 10-year experience. Massachusetts General Hospital. Ann Thorac Surg 1981;31:305-309

- Beta Blocker เพื่อลด dP/dT
- systolic blood pressure <120 mmHg
- Mean arterial pressure < 80 mmHg
- HR<100/min
- Urine output 0.5ml/kg/hr

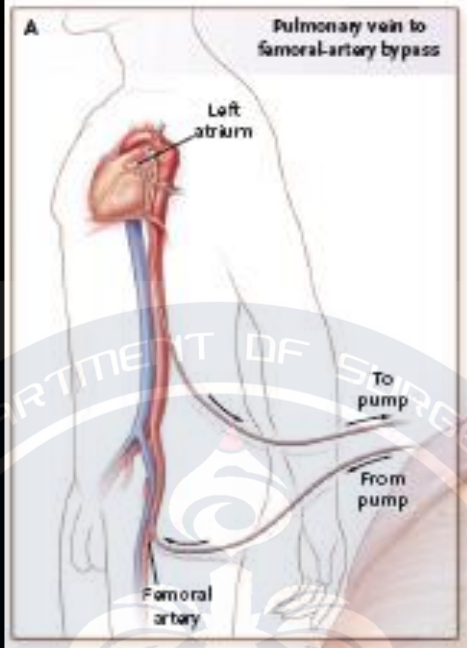
Timing of repair

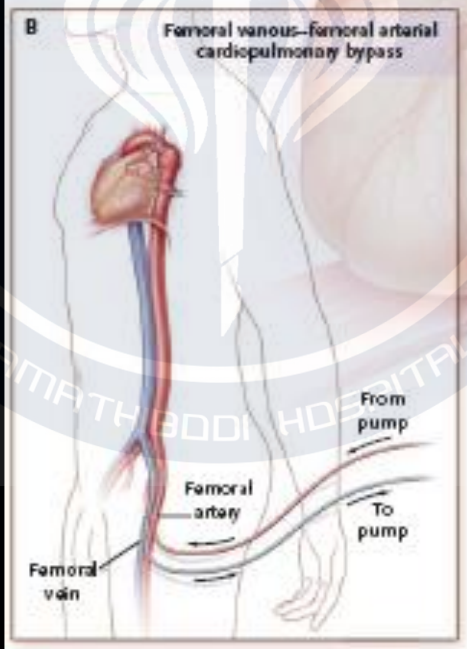
- As Soon As Possible when patient is stable
- As Soon As Possible when personnel are ready
- As Soon As Possible when equipment is available

- Primary repair
- Graft interposition
- Distal bypass options
  - None
  - Passive bypass (Gott shunt, makeshift shunt)
  - Active bypass (pump assisted bypass)
    - Conventional cardiopulmonary bypass (full heparinization)
    - Left heart bypass (without heparinization)

- Standard procedure for repair is Left heart bypass

Arch Surg. 1993 Jul;128(7):746-50; discussion 50-2





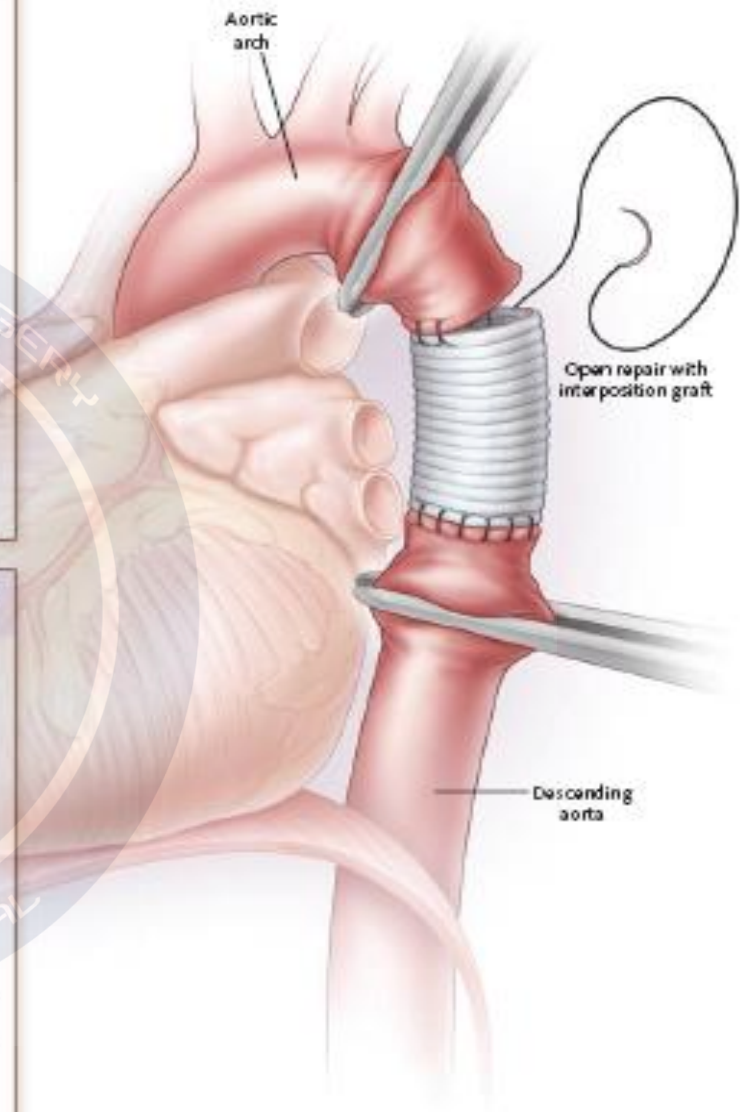


Figure 4. Two Bypass Procedures for Repair of Blunt Aortic Injury.

Panel A shows a bypass procedure from the pulmonary vein (left atrium) to the femoral artery with a centrifugal pump. The main drawing depicts open repair with an interposition graft at a typical location in the isthmus. Panel B shows femoral venous–femoral arterial cardiopulmonary bypass, which is performed by inserting a long cannula through the femoral vein into the right atrium.

Operative Repair or Endovascular Stent Graft in Blunt Traumatic Thoracic Aortic Injuries: Results of an American Association for the Surgery of Trauma Multi center Study

J Trauma. 2008;64:561-571

AAST

- Operative repair (n=68)
  - Clamp and sew 16.2(11/68)
  - Bypass 83.8 (57/68)
- Endovascular stent graft (n=117)
  - TAG (Gore) 78.6(92/117)
  - Zenith (Cook) 16.2(19/117)
  - Talent (Medronic) 3.4(4/117)
  - Vanguard (Boston) 1.7(2/117)

J Trauma. 2008;64:561-571

Concerns

- Sizing
- High origin of Adamkiewicz's
- Brain embolism
- Long term follow up

Concerns

- Sizing
- High origin of Adamkiewicz's
- Brain embolism
- Long term follow up

Sizing

- Ao size in hypotension and hypertension size increases 30%
- Tight angle in young adult

van Prehn J, van Herwaarden JA, Muhs BE, Arnofsky A, Moll FL, Verhagen HJ. Difficulties with endograft sizing in a patient with traumatic rupture of the thoracic aorta: the possible influence of hypovolemic shock J Vasc Surg. 2008 Jun;47(6):1333-6

Concerns

- Sizing
- High origin of Adamkiewicz's
- Brain embolism
- Long term follow up

Adamkiewicz's plexus

- High origin of Adamkiewicz's 15%
- CSF drainage
- Keep stable BP
- Medications

Concerns

- Sizing
- High origin of Adamkiewicz's
- Brain embolism
- Long term follow up

Brain embolism

- < 3%

Concerns

- Sizing
- High origin of Adamkiewicz's
- Brain embolism
- Long term follow up

What we did!


PHILIPS
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NSS
4 8:08PM


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CRAN 2°
FD 37 cm
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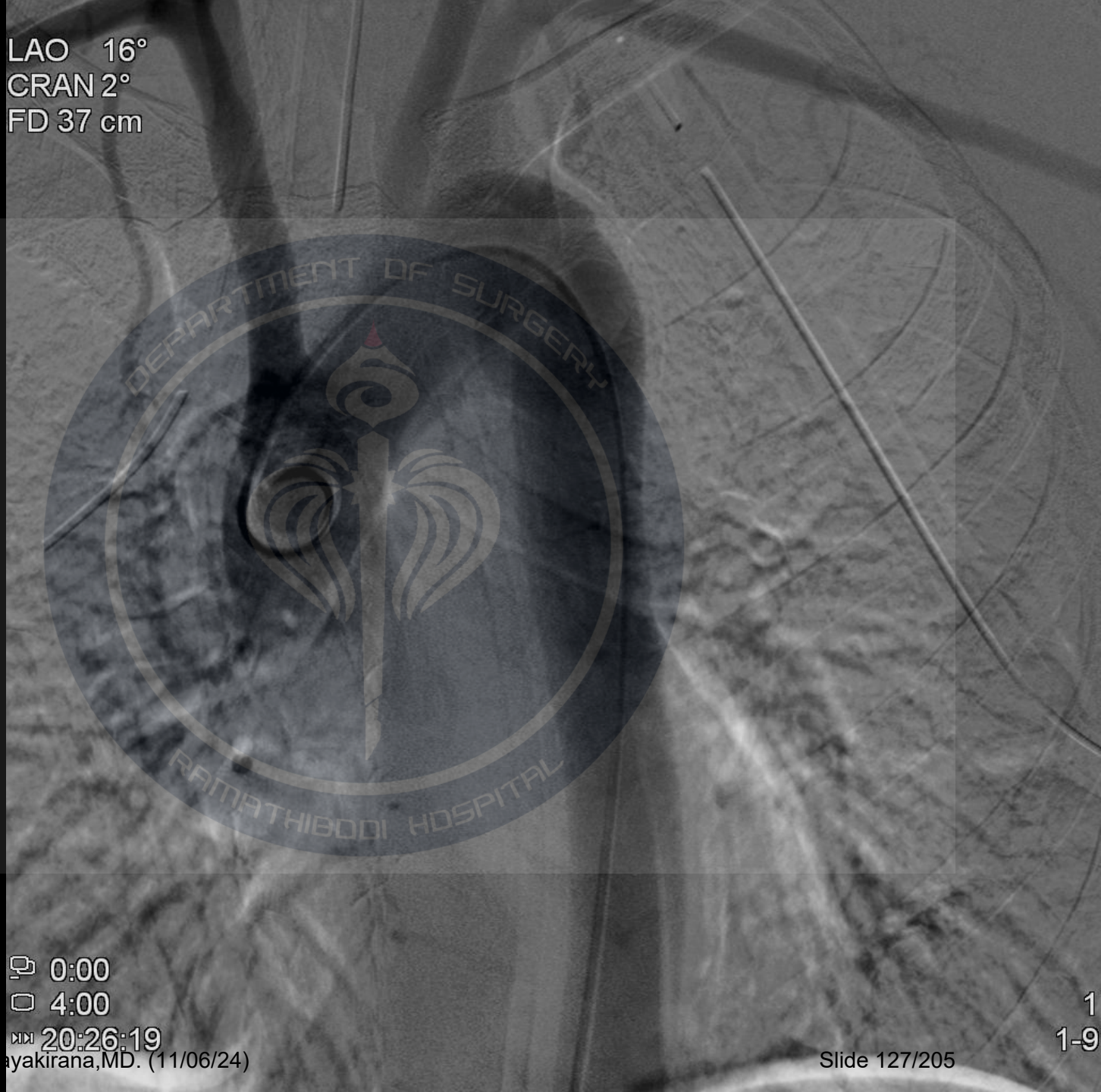
4:00
20:26:19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FD 37 cm
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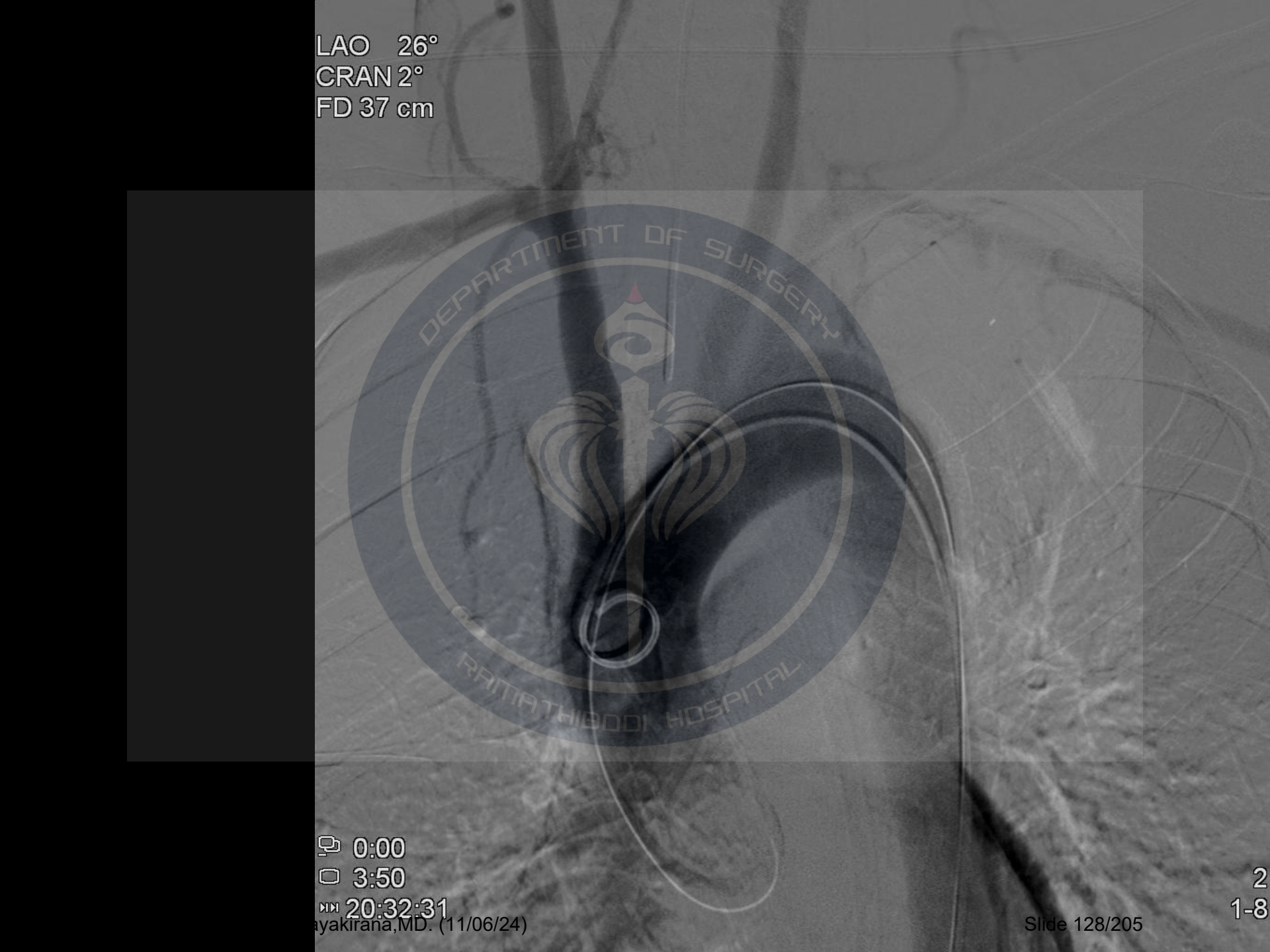
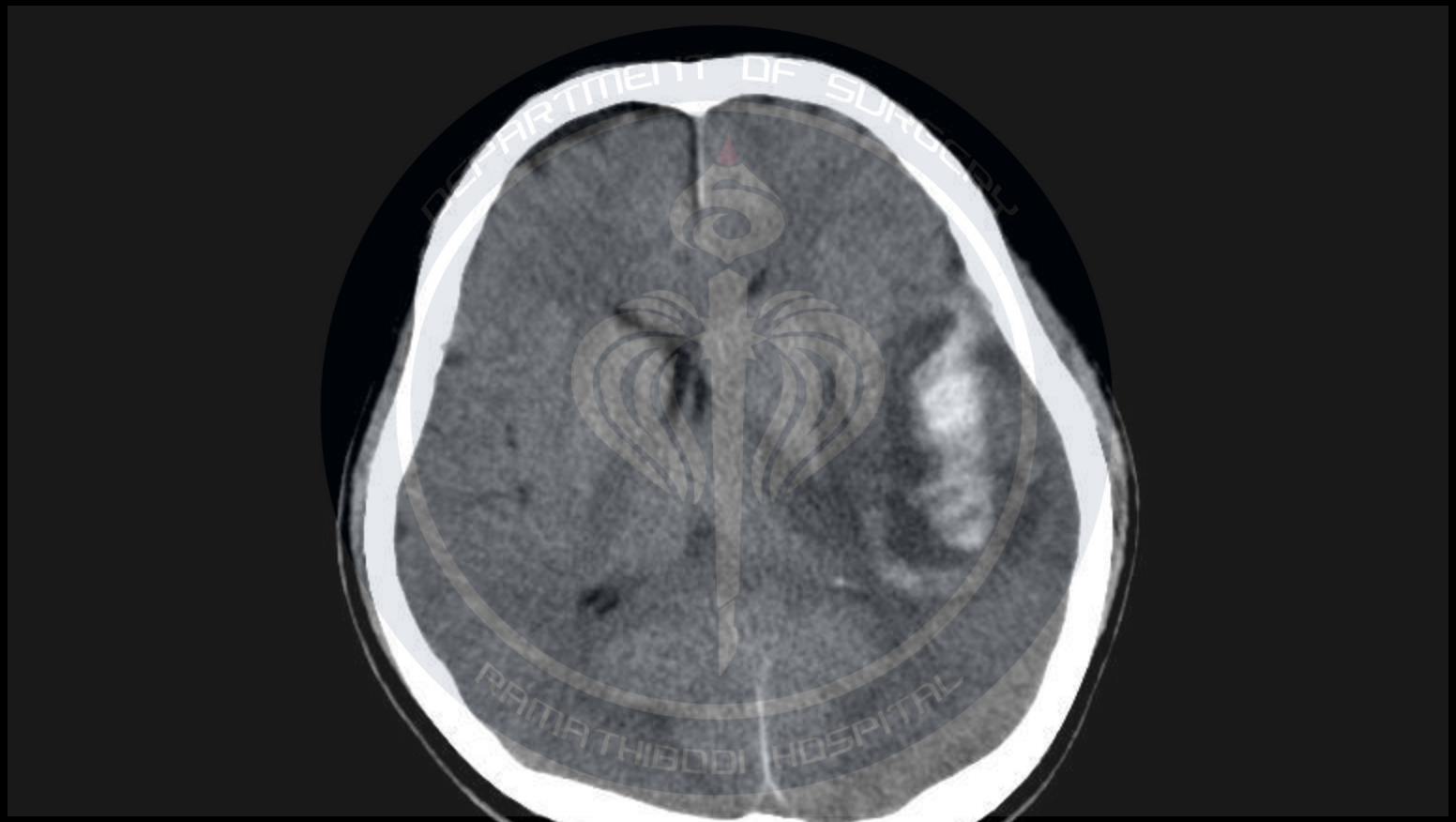



NSS
4 8:58PM

Heparin?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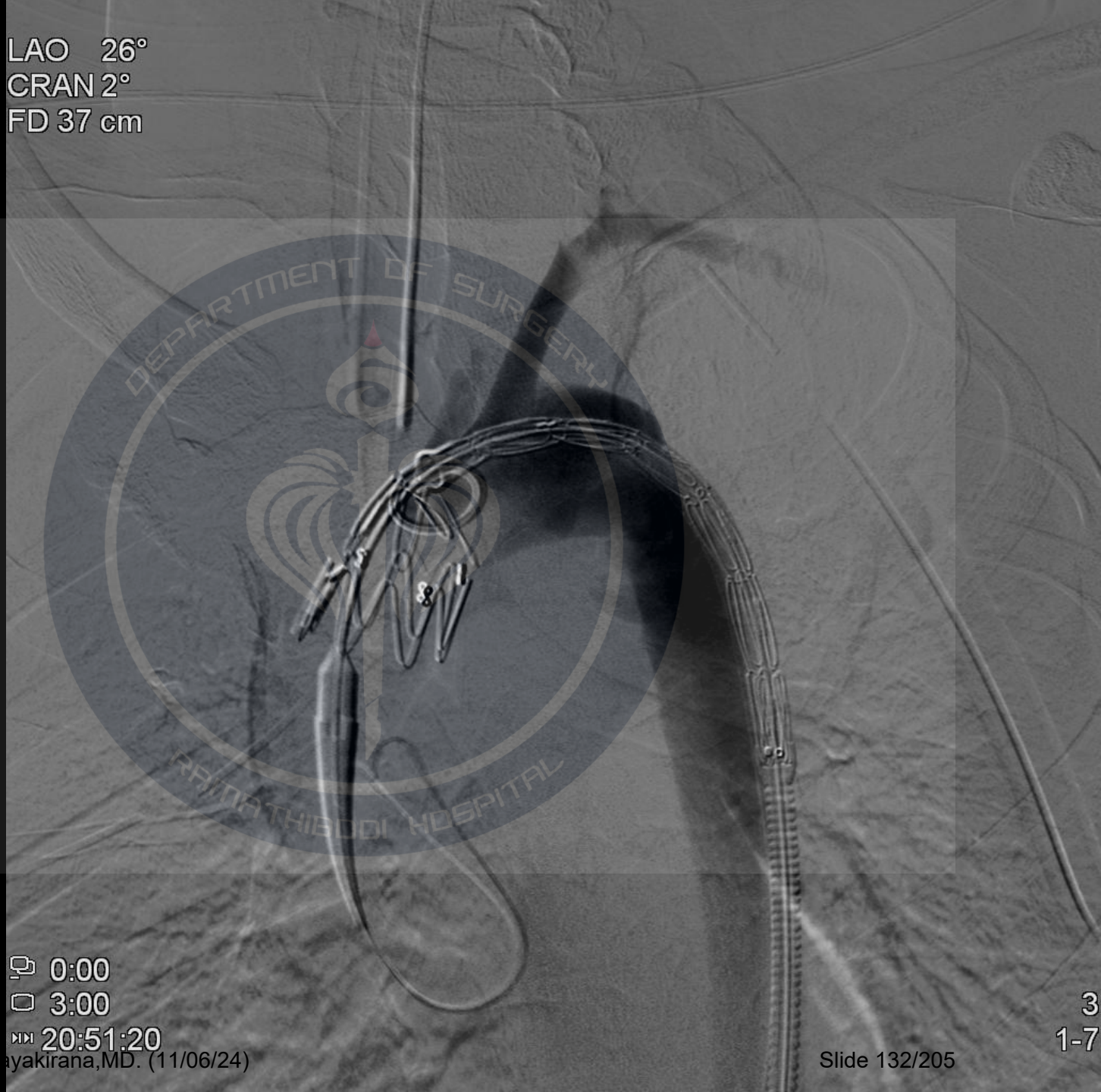
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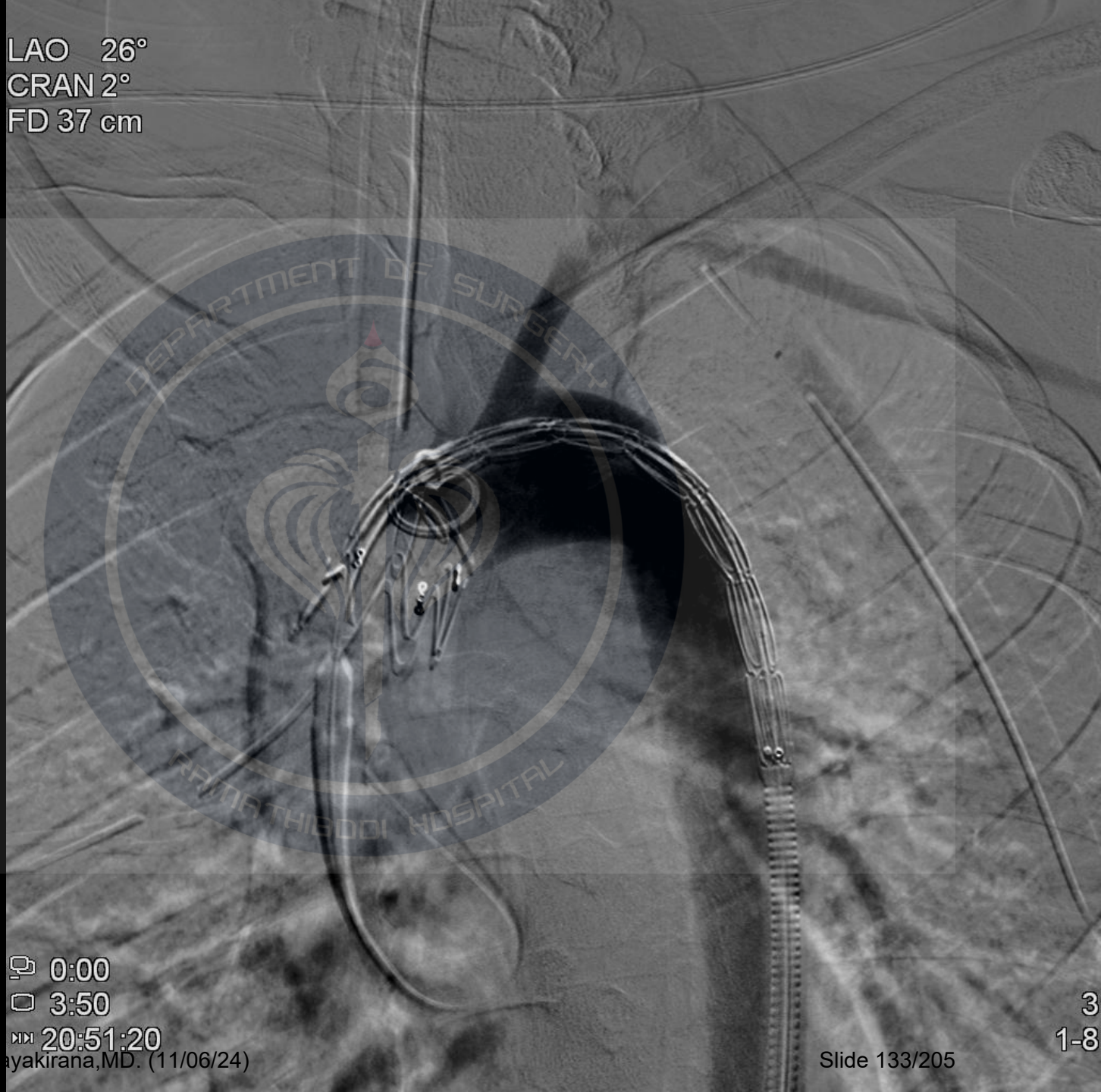
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3
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LAO 26°
CRAN 2°
FD 37 cm
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20:51:20
3
1-10


LAO 26°
CRAN 2°
FD 37 cm
0:00
3:50
20:51:20
3
1-8

Left subclavian ?

DATA

Retrospective cohort study
(2008 to 2018)

Collect data from Hospital database using ICD-10 code as S250 which defines as "Injury of thoracic aorta"

CRITERIA

Inclusion criteria
BTAI patients treated by TEVAR

Exclusion criteria
Landing in zone 0, zone 1 or zone 4

Study Design

DEFINITION

Adequate neck length
as more than 15mm

PATIENTS ALLOCATION

Divide patients into two groups as adequate and inadequate proximal landing zone group

38
BTAI Patients

Exclude landing
in zone 0 and 1
2 patients

Inadequate landing
zone
(<15mm)
17 Patients

Adequate landing
zone
(>15mm)
19 Patients

Patient characteristic	Inadequate (n=17)	Adequate (n=19)	p-value
Age, y, mean±SD	41.5±16.6	37.6±13.1	0.445
Male, n (%)	12 (70.6%)	18 (90.7%)	0.081
Mechanism			
Motorcycle	7 (41.2%)	10 (53%)	
Car	6 (35.3%)	6 (31.6%)	0.376
Fall	4 (23.5%)	1 (5.3%)	
Direct blunt chest	0 (0%)	2 (10.5%)	
Injury severity score (ISS)	42.2±8.0	38.5±8.9	0.210

Patient characteristic	Inadequate (n=17)	Adequate (n=19)	p-value
Grading of injury			
Grade 2	0 (0%)	2 (10.5%)	0.487
Grade 3	17 (100%)	17 (89.5%)	
Neck length	11.9±2.6	18.8±1.8	0.002
Neck diameter	23.3±4.6	23.8±3.5	0.691
Stent size	26.7±3.6	27.4±3.4	0.702
Stent diameter	145.6±10.3	143.9±15.2	0.701
Landing zone			
Zone 2	0 (0%)	4 (21%)	0.106
Zone 3	17 (100%)	15 (79%)	

Outcome	Inadequate (n=17)	Adequate (n=19)	p-value
Death			
In-hospital death	1 (5.9%)	1 (5.3%)	1
Aortic-related death	0 (0%)	0 (0%)	1
Hospital stay	17.6±9.1	20.2±19.5	0.616
ICU stay	4±3.6	5.3±6.7	0.475
Complication			
Endoleak type I	2 (11.8%)	3 (15.8%)	0.300
Endoleak type II	3 (17.6%)	1 (5.3%)	0.260
Spinal cord injury	0 (0%)	0 (0%)	1
Stroke	0 (0%)	0 (0%)	1
Left arm ischemia	0 (0%)	0 (0%)	1
Re-intervention	0 (0%)	0 (0%)	1

Conclusion

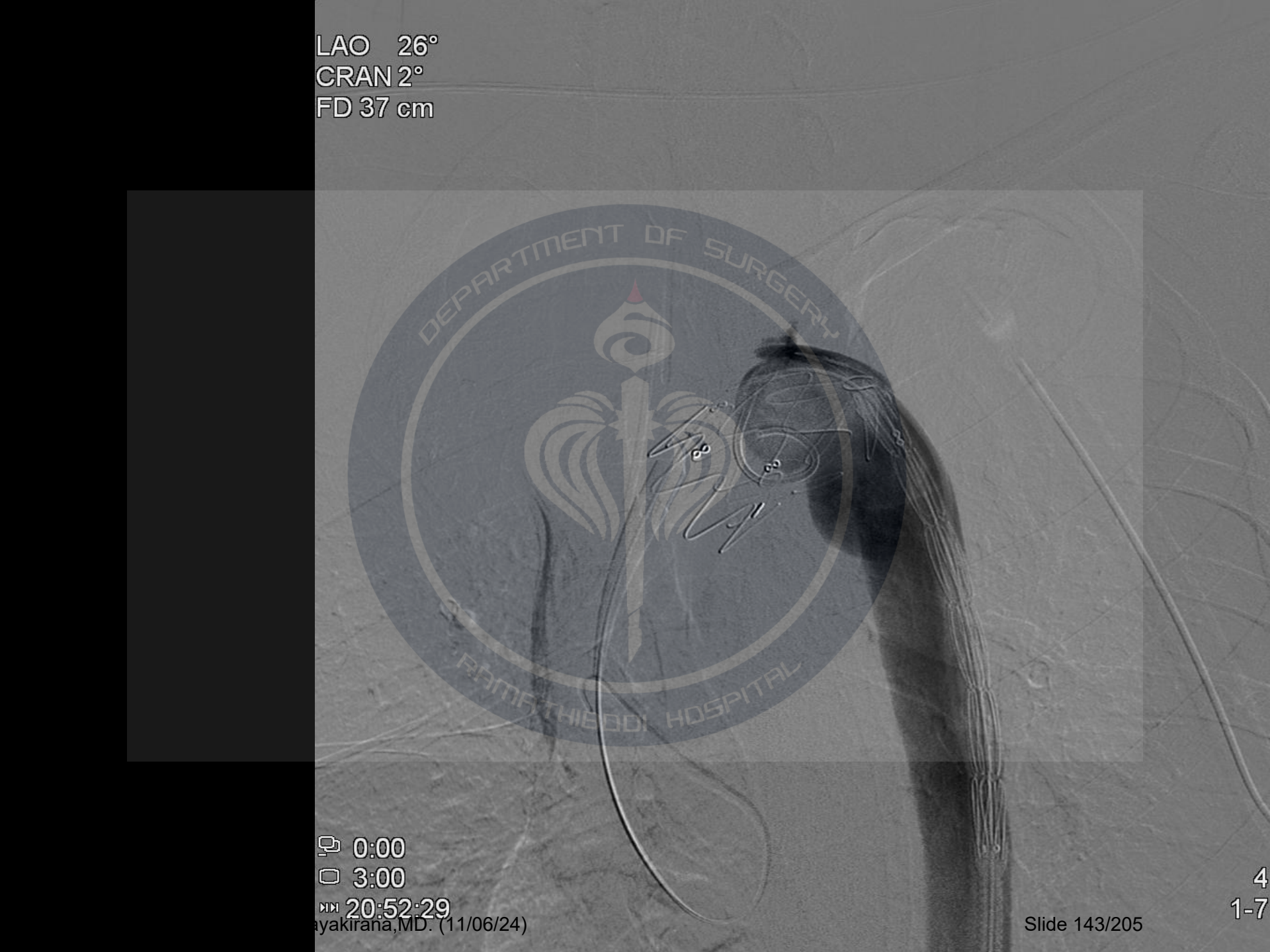
36 BTAI patients

Inadequate landing zone (n=17)	Adequate landing zone (n=19)
1 Death No Aortic related death 2 Endoleak type IA 3 Endoleak type II	1 Death No Aortic-related death 3 Endoleak type IA 1 Endoleak type II

No difference in patient characteristic profile

p-value >0.05

In BTAI with aortic isthmus injury, TEVAR can be performed in **Zone 3** to preserved left subclavian artery **despite of inadequate landing zone.**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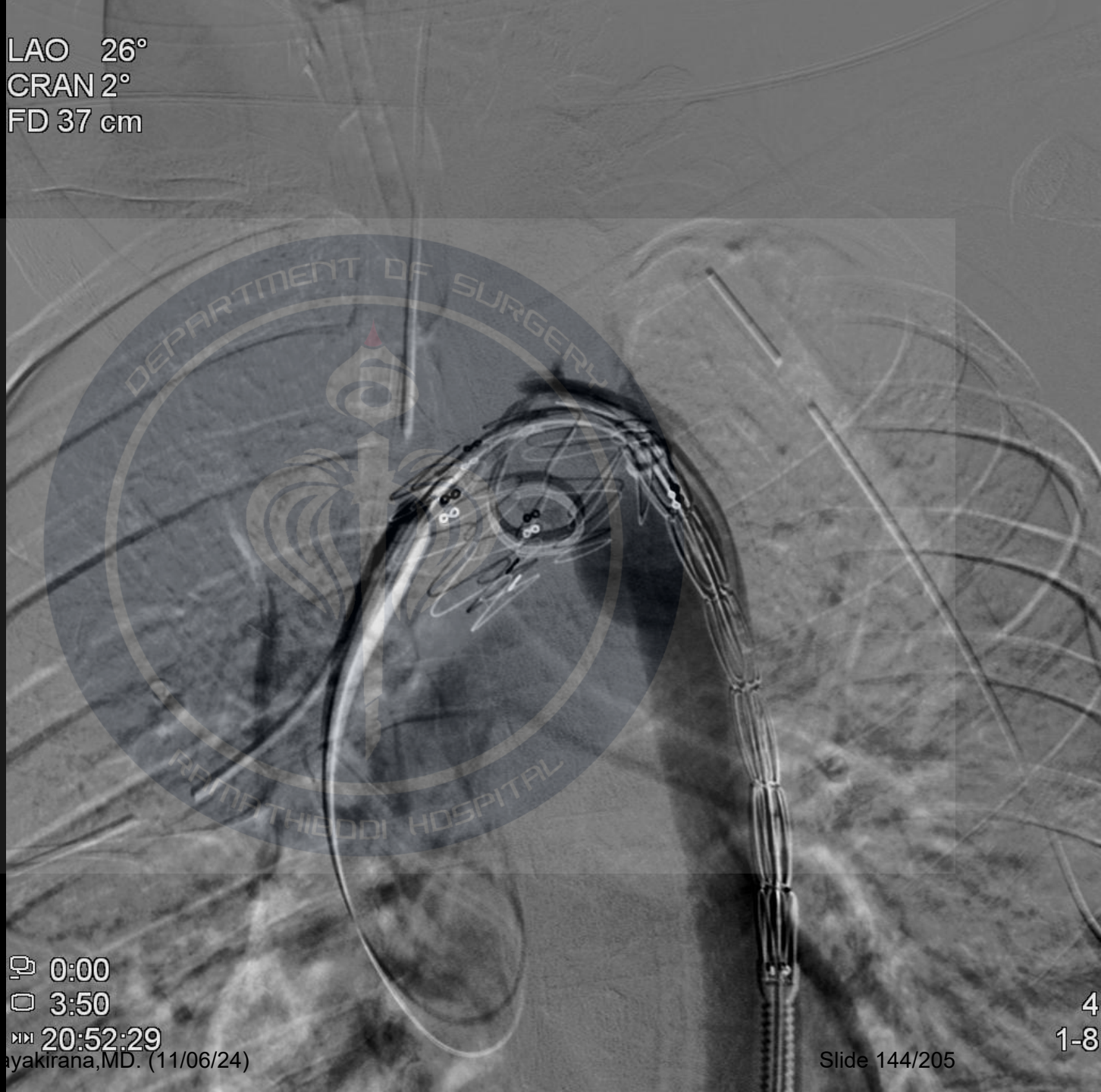
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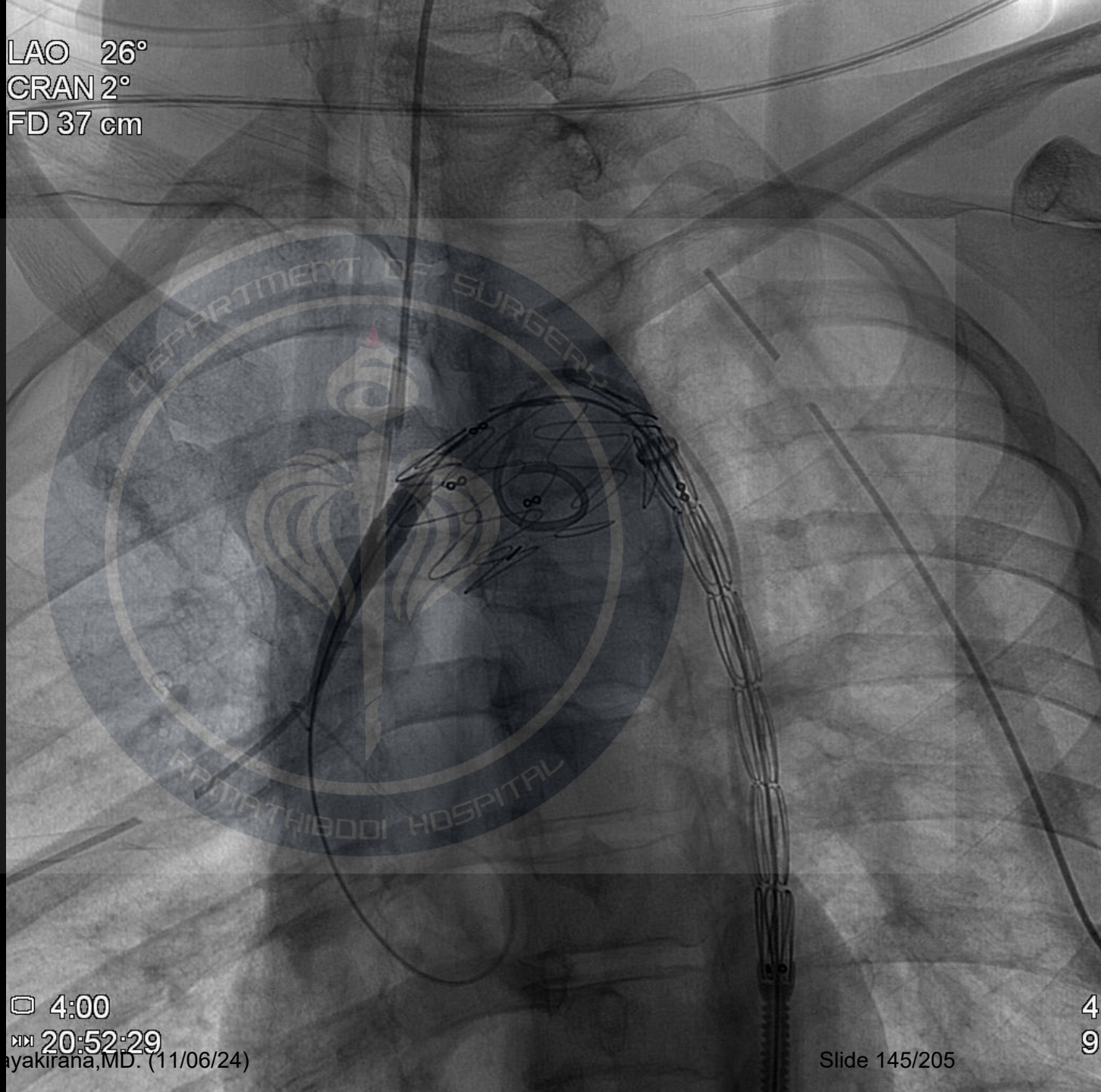
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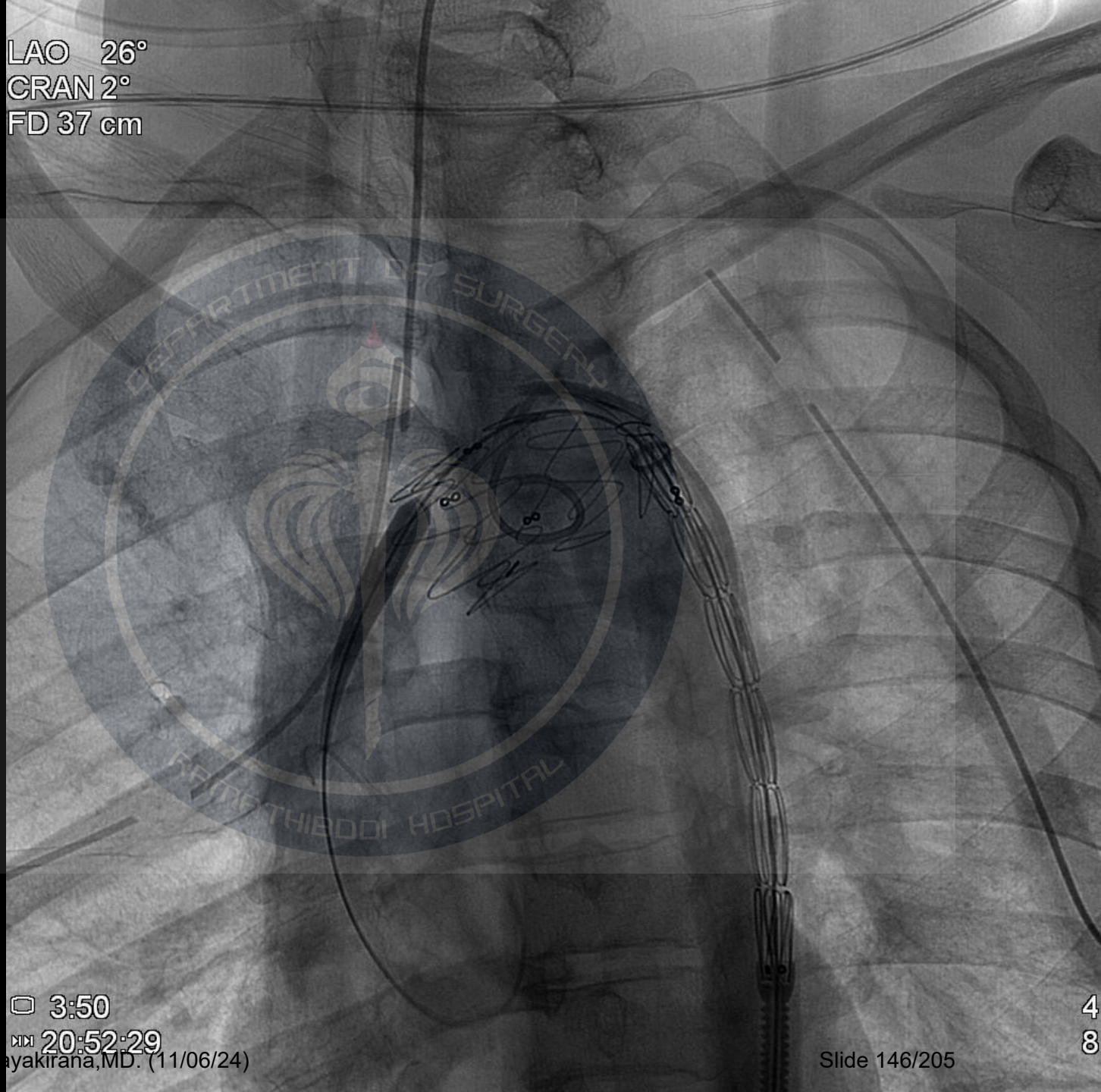
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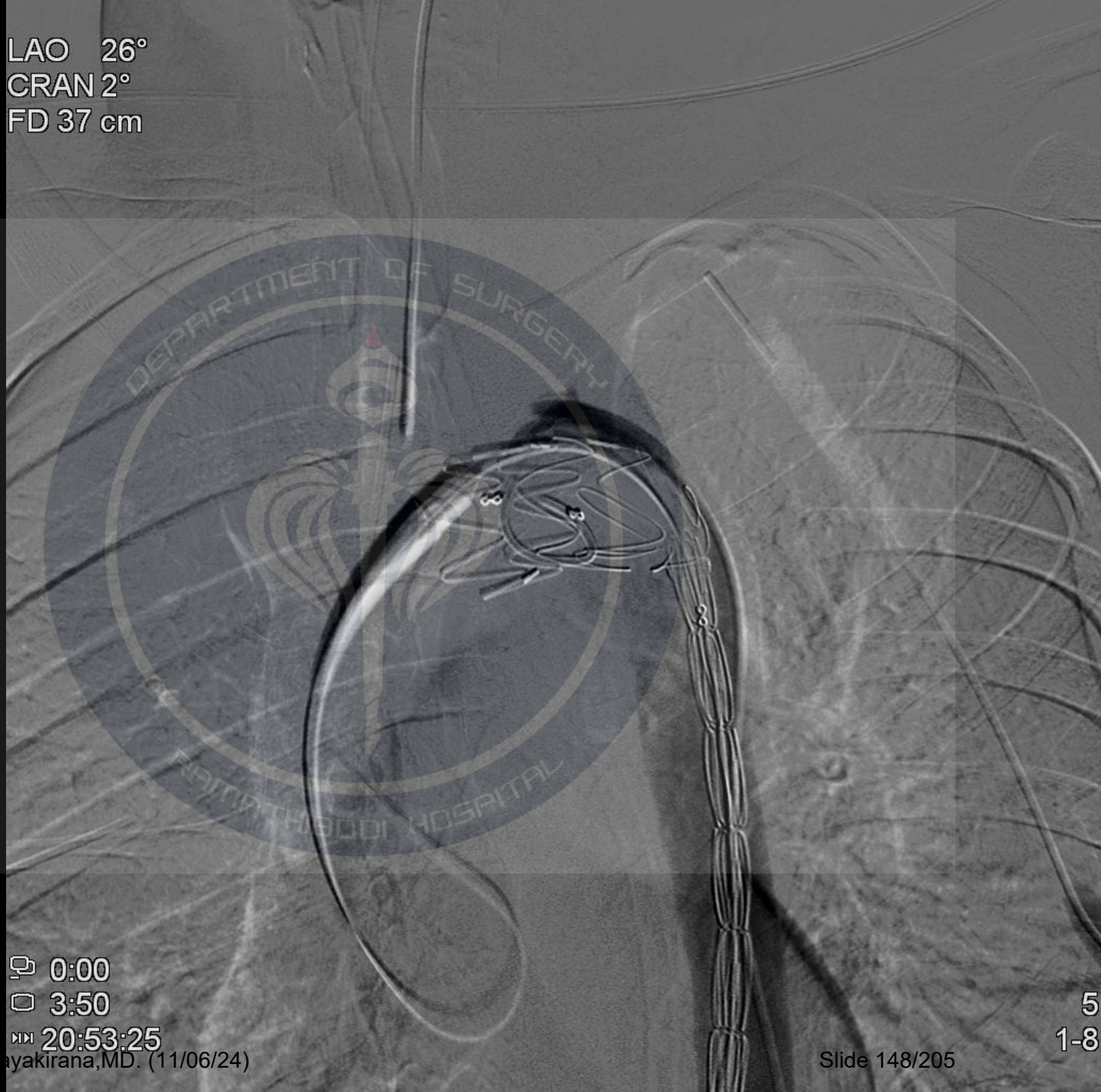
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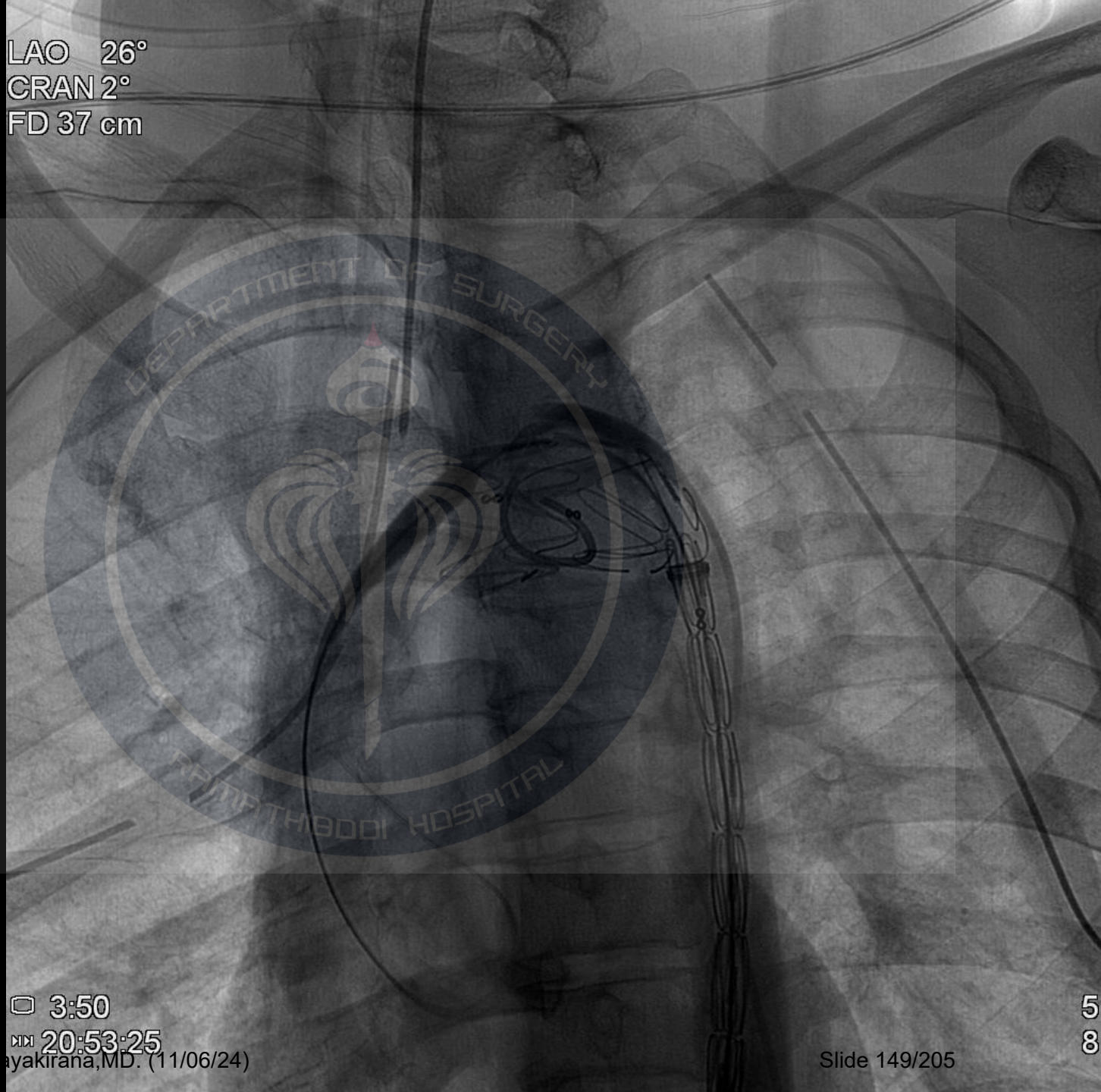
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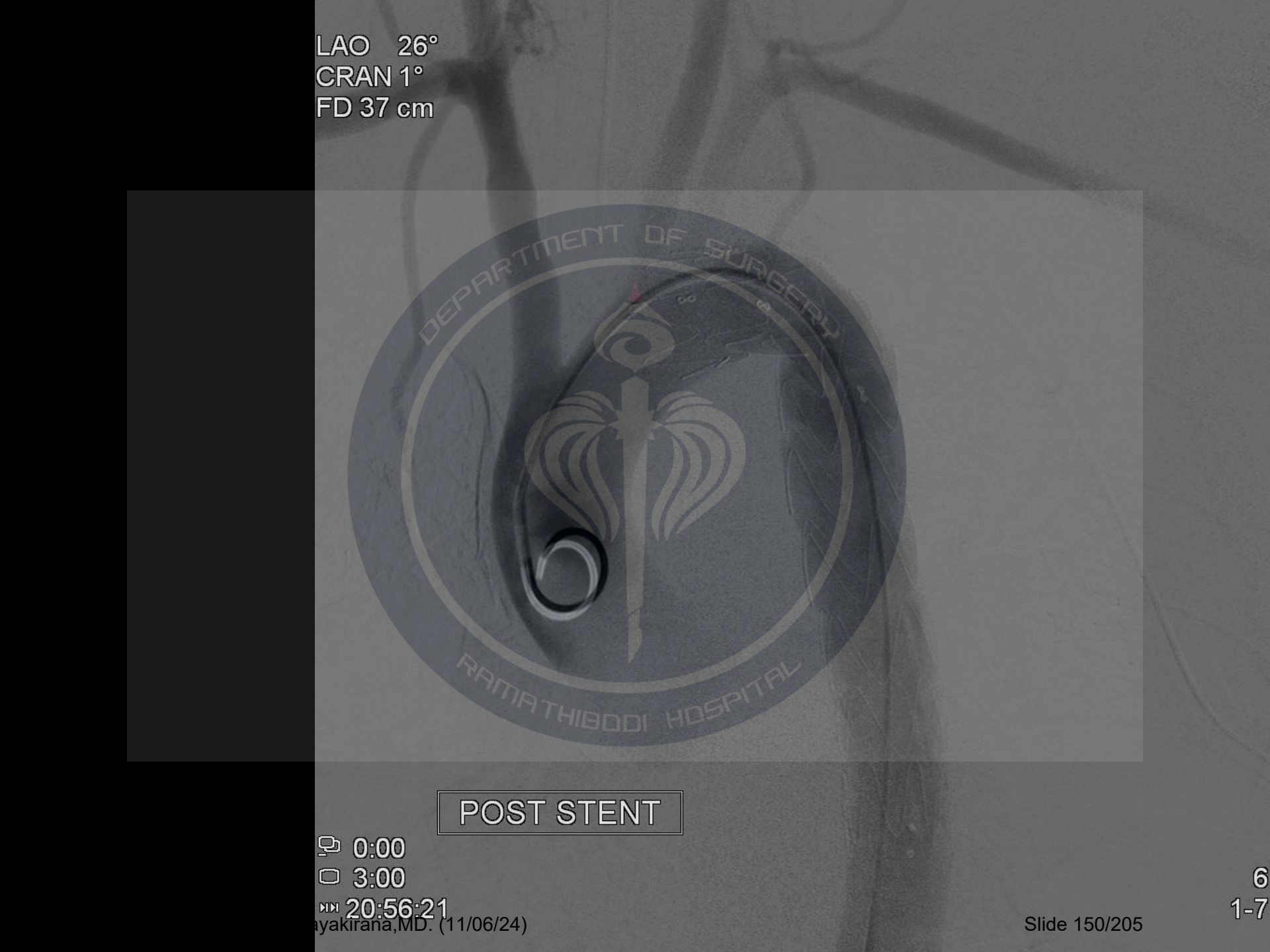
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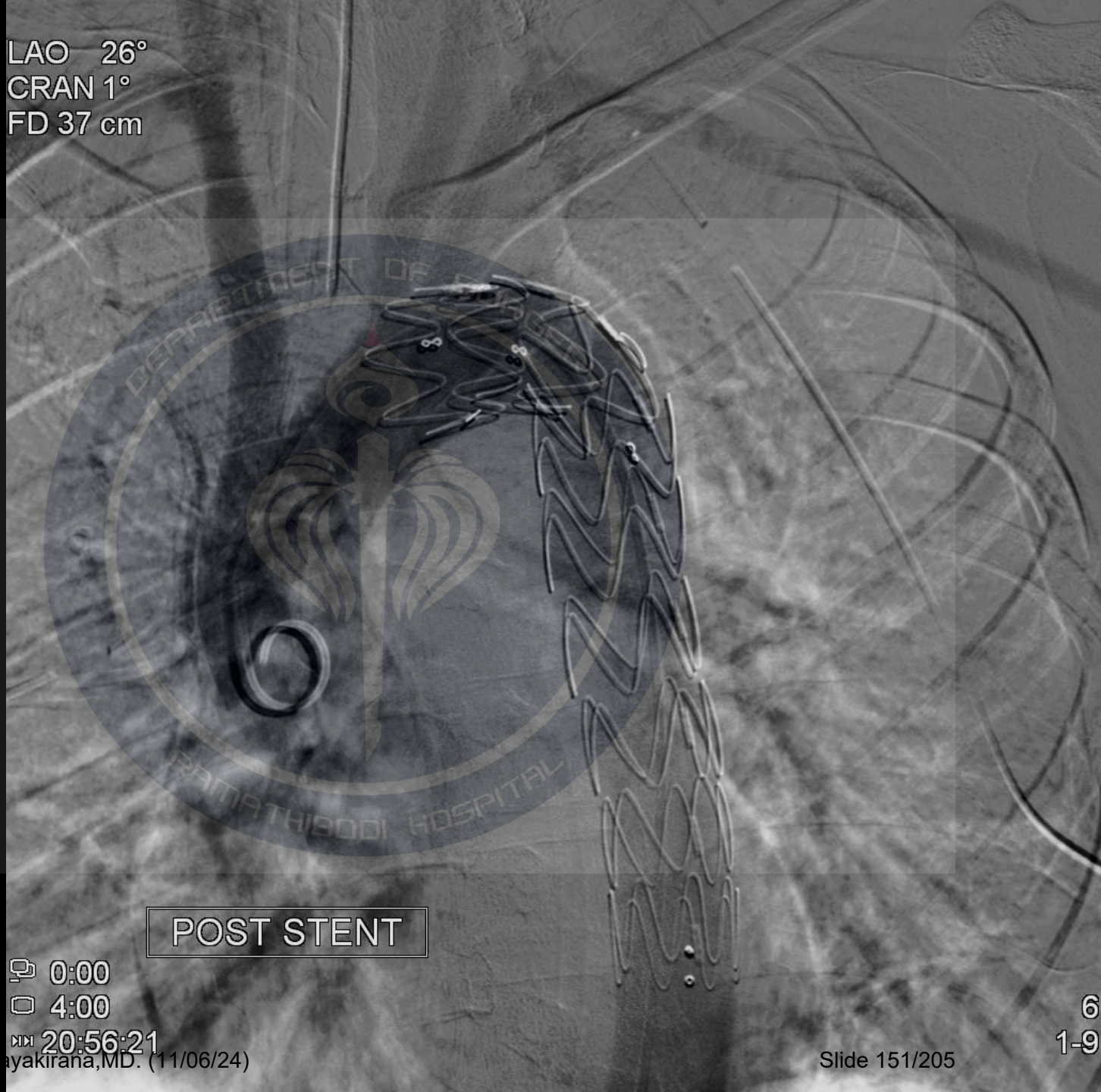
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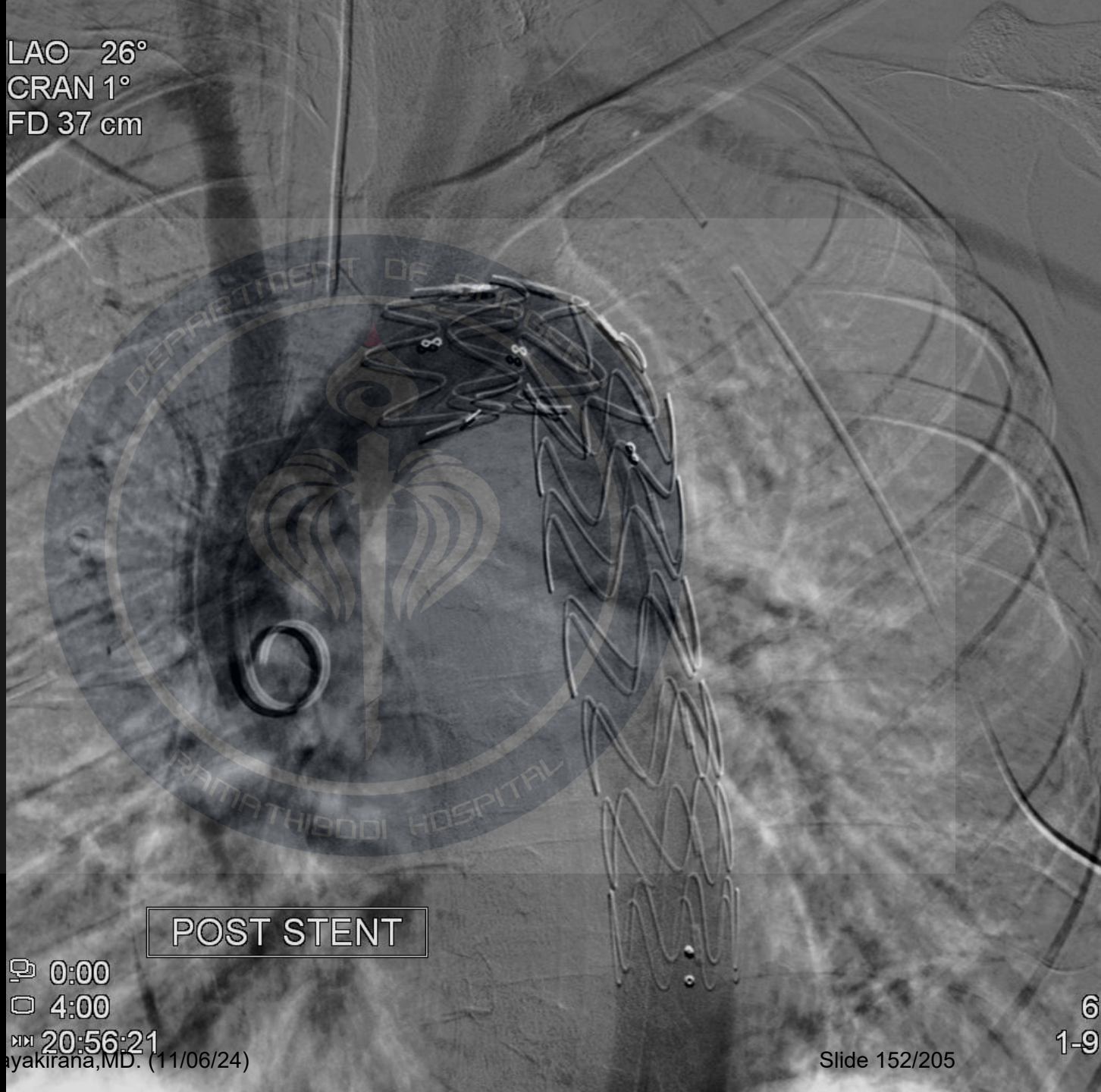
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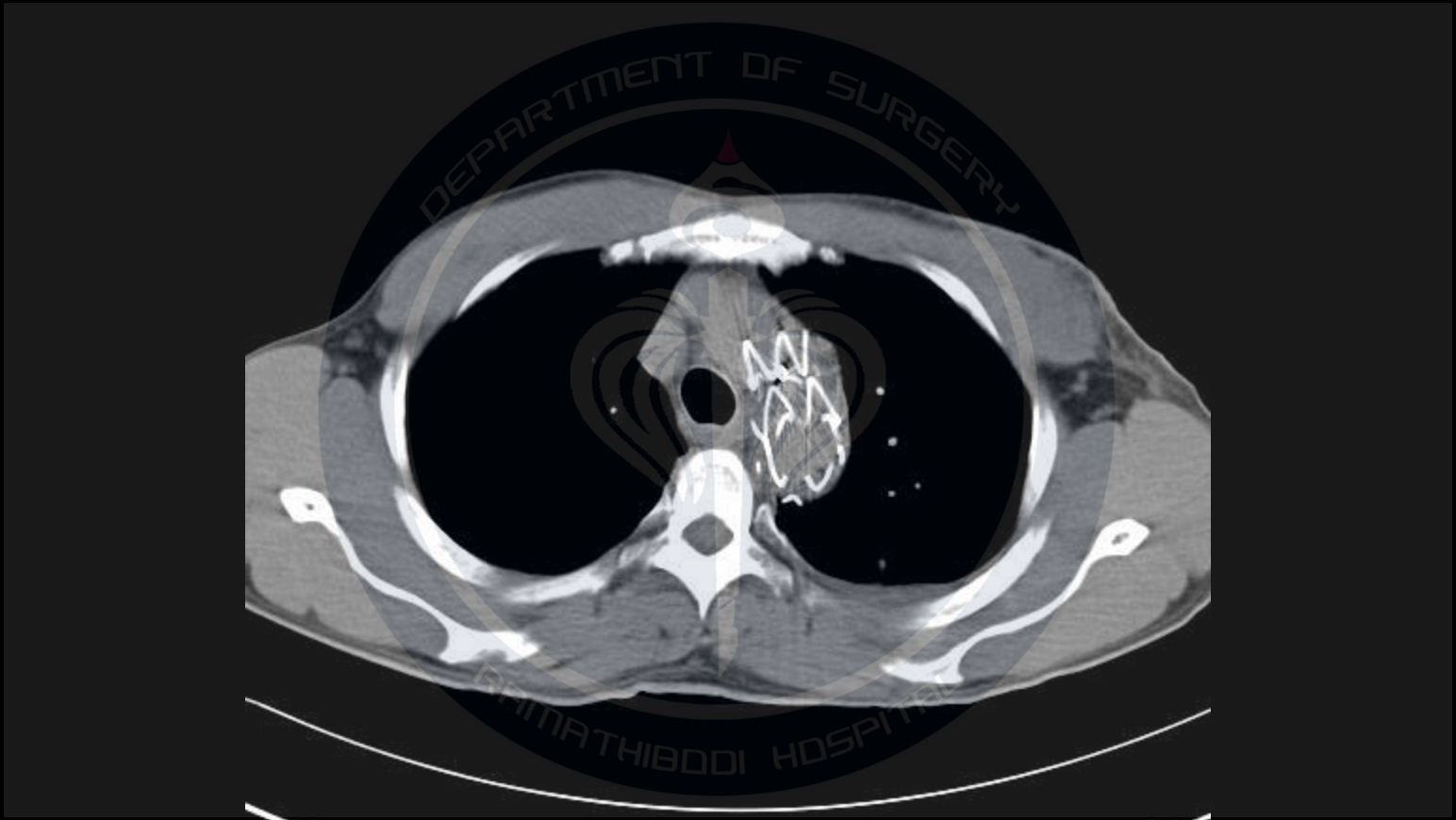
10 days post operative CTA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DEPARTMENT OF SURGERY
SIRIRAJ HOSPITAL


DEPARTMENT OF SURGERY
RAJAVITHI HOSPITAL


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RAJAVITHI HOSPITAL


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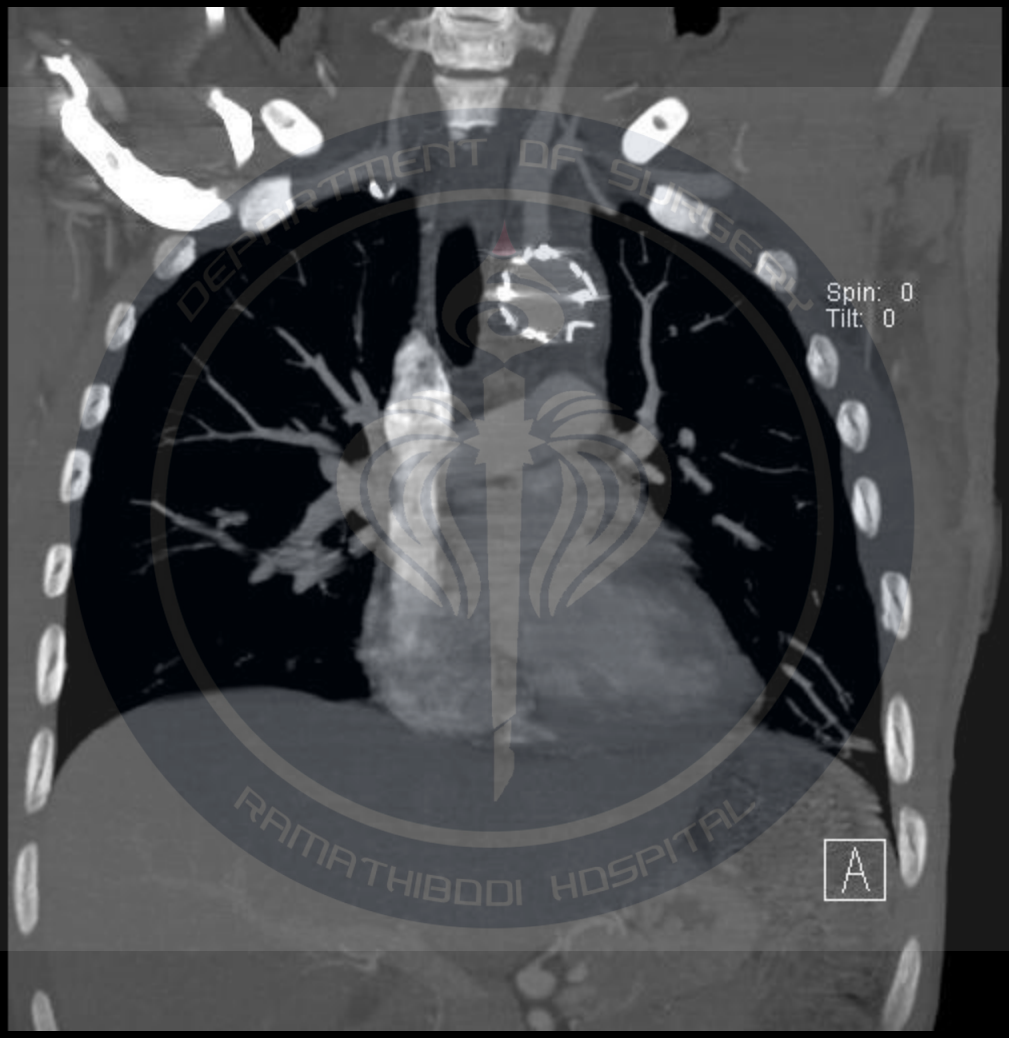
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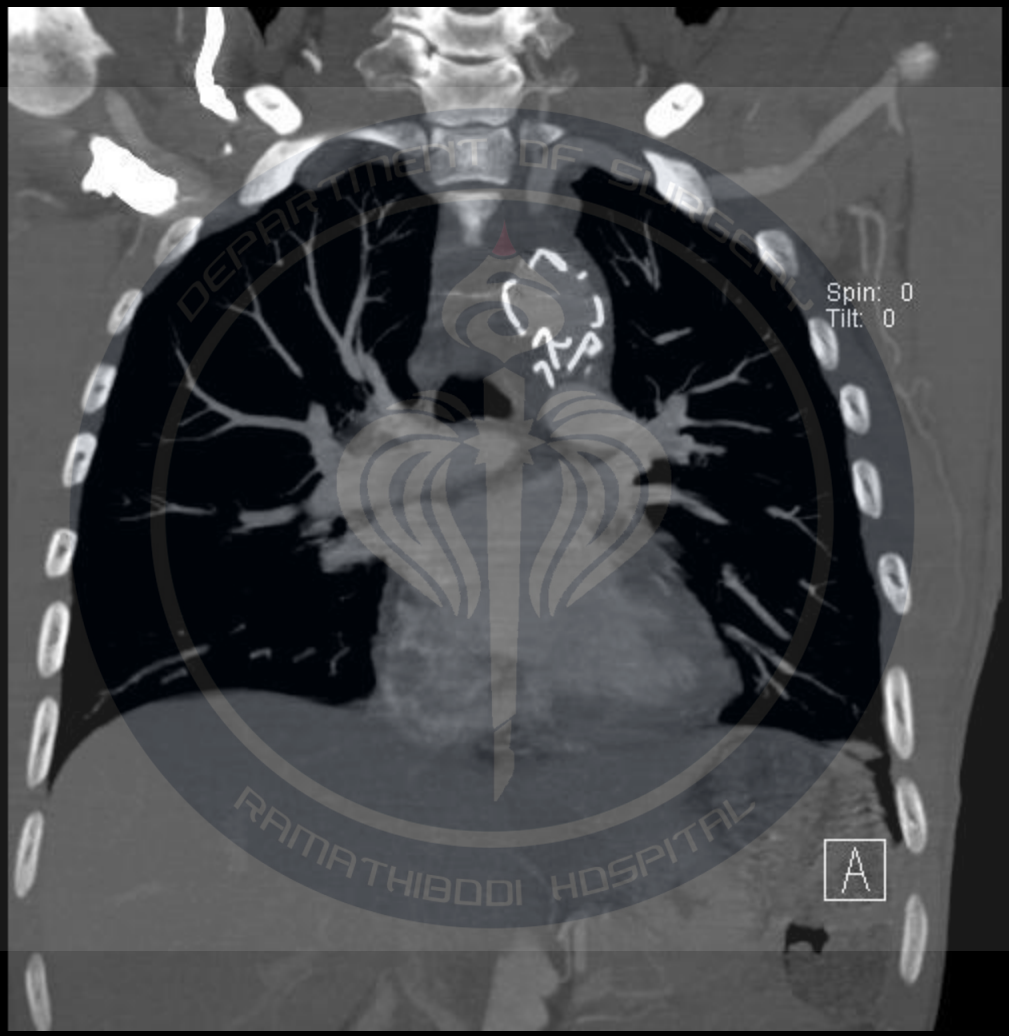
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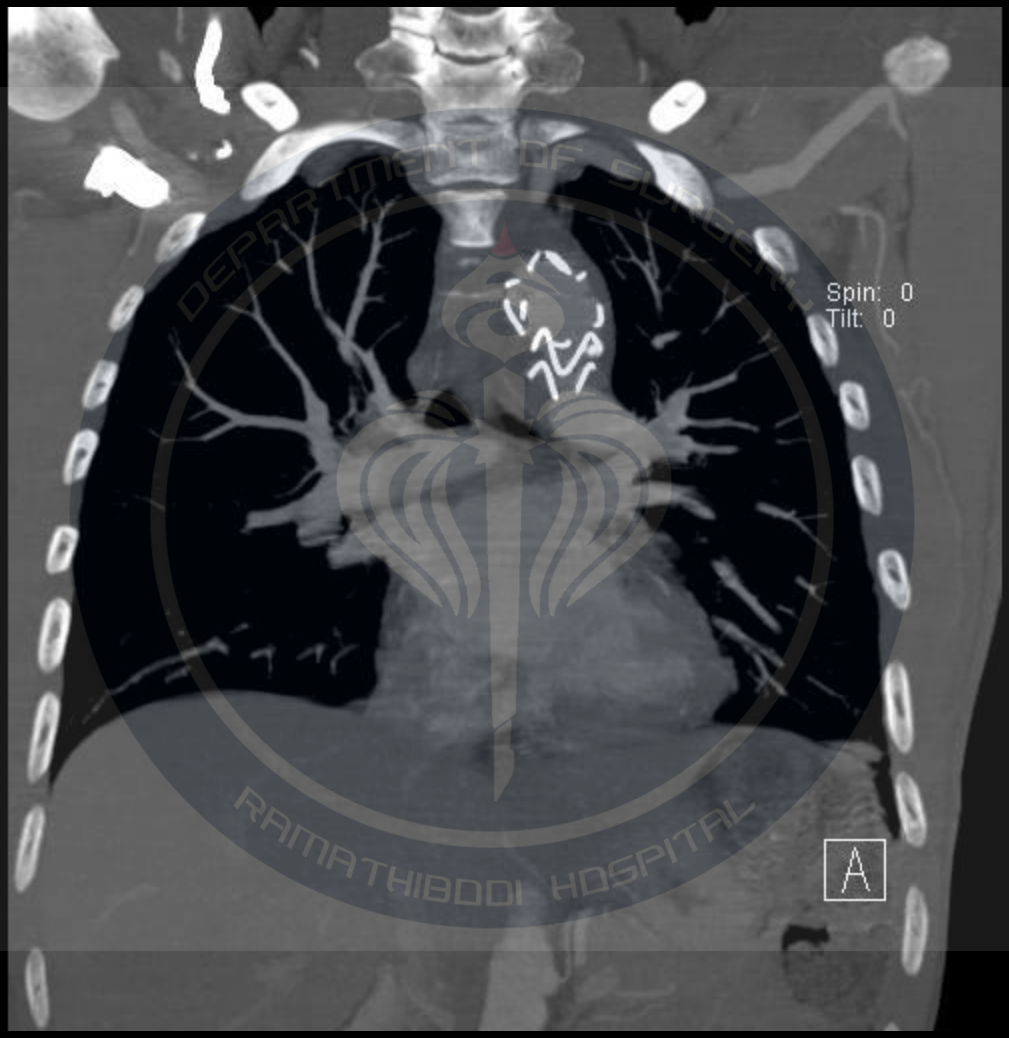
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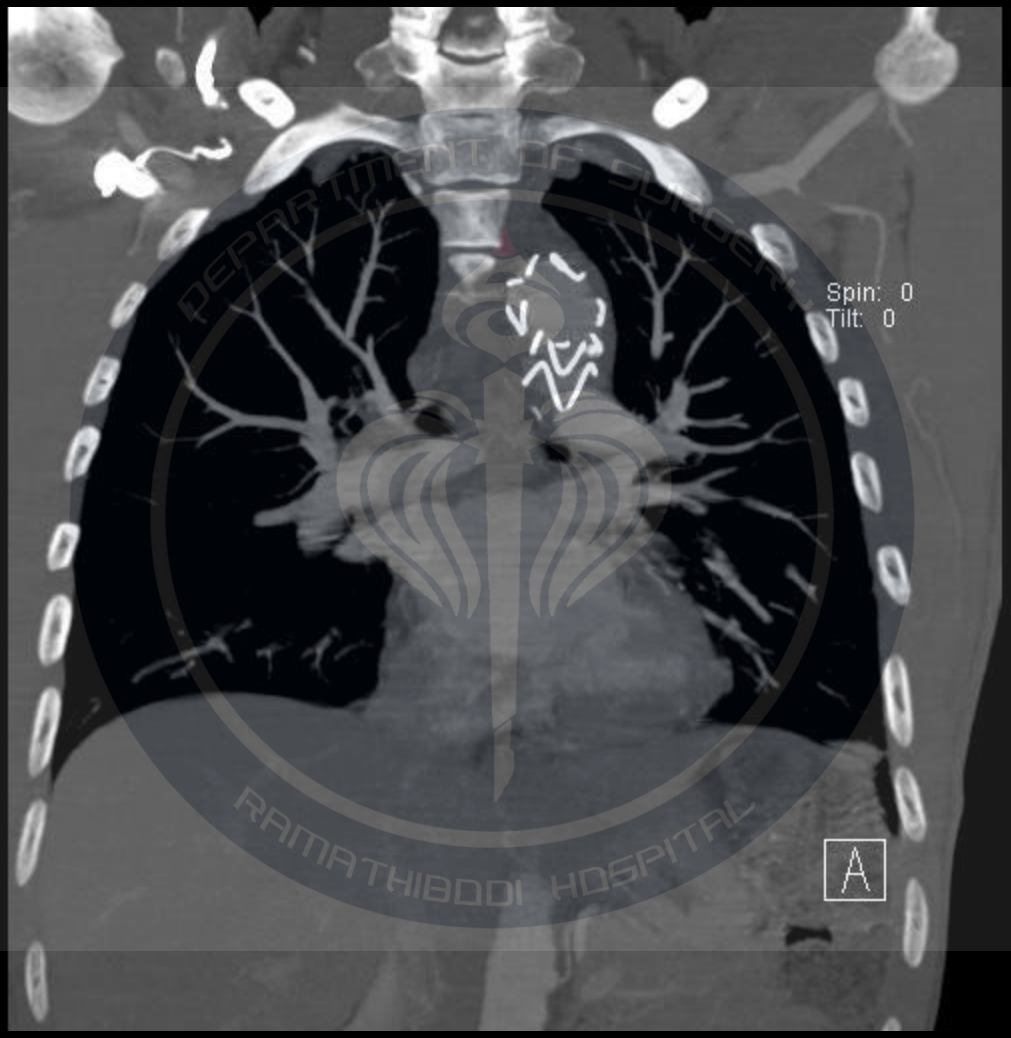
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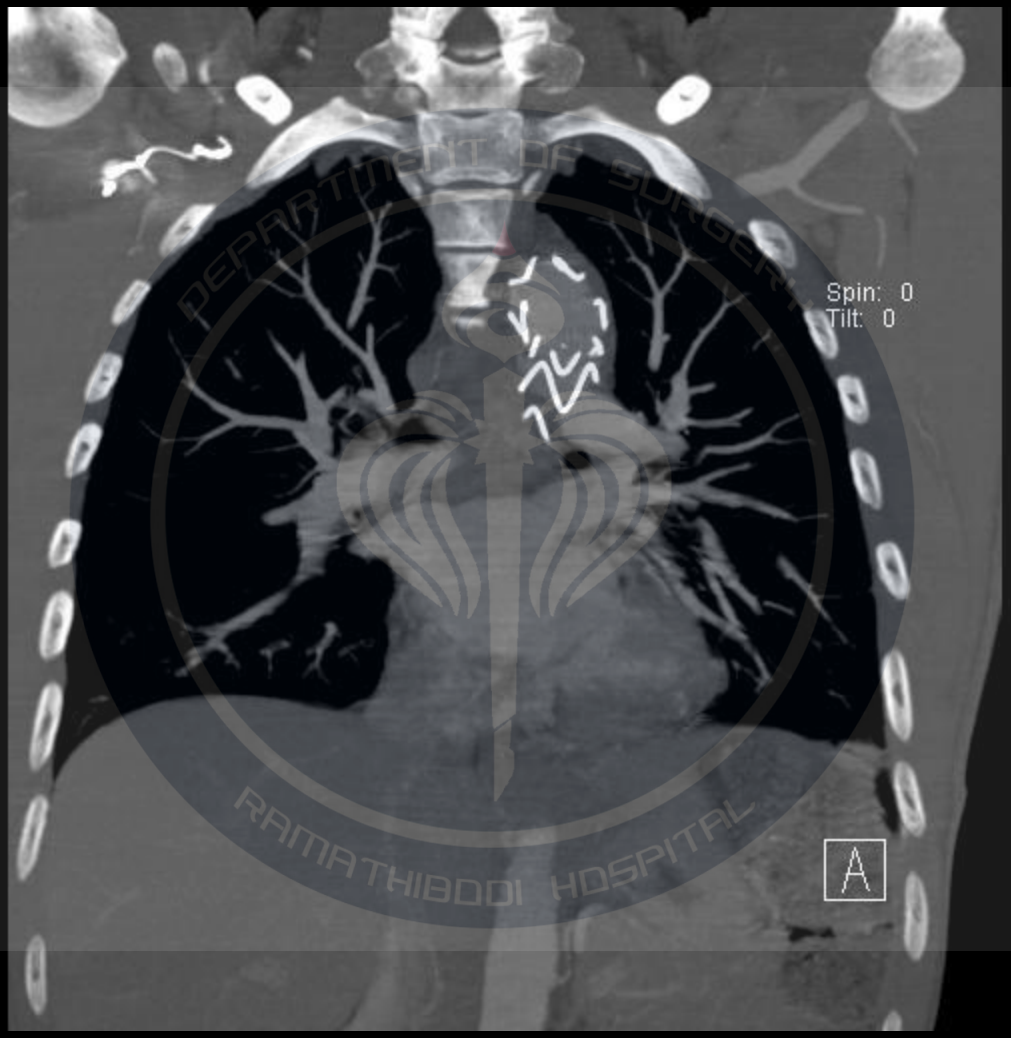
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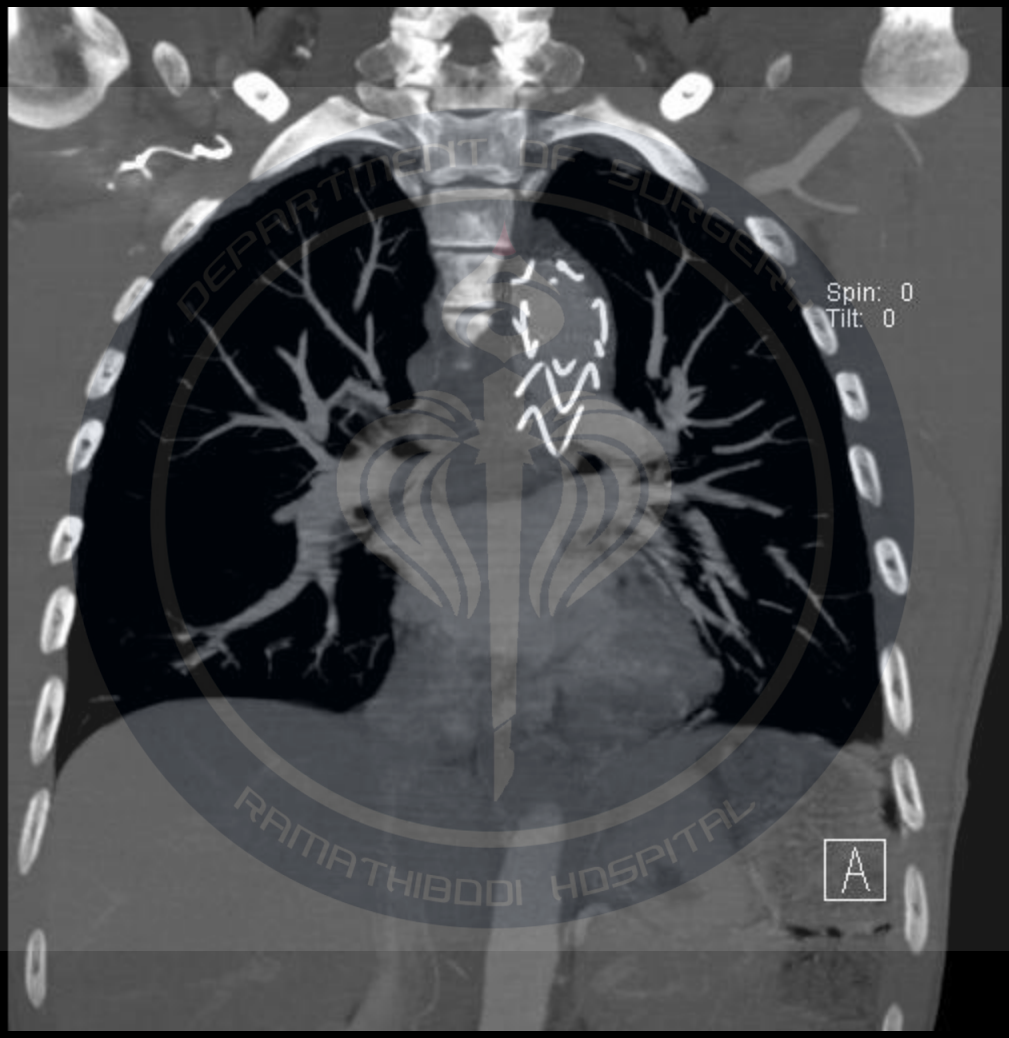
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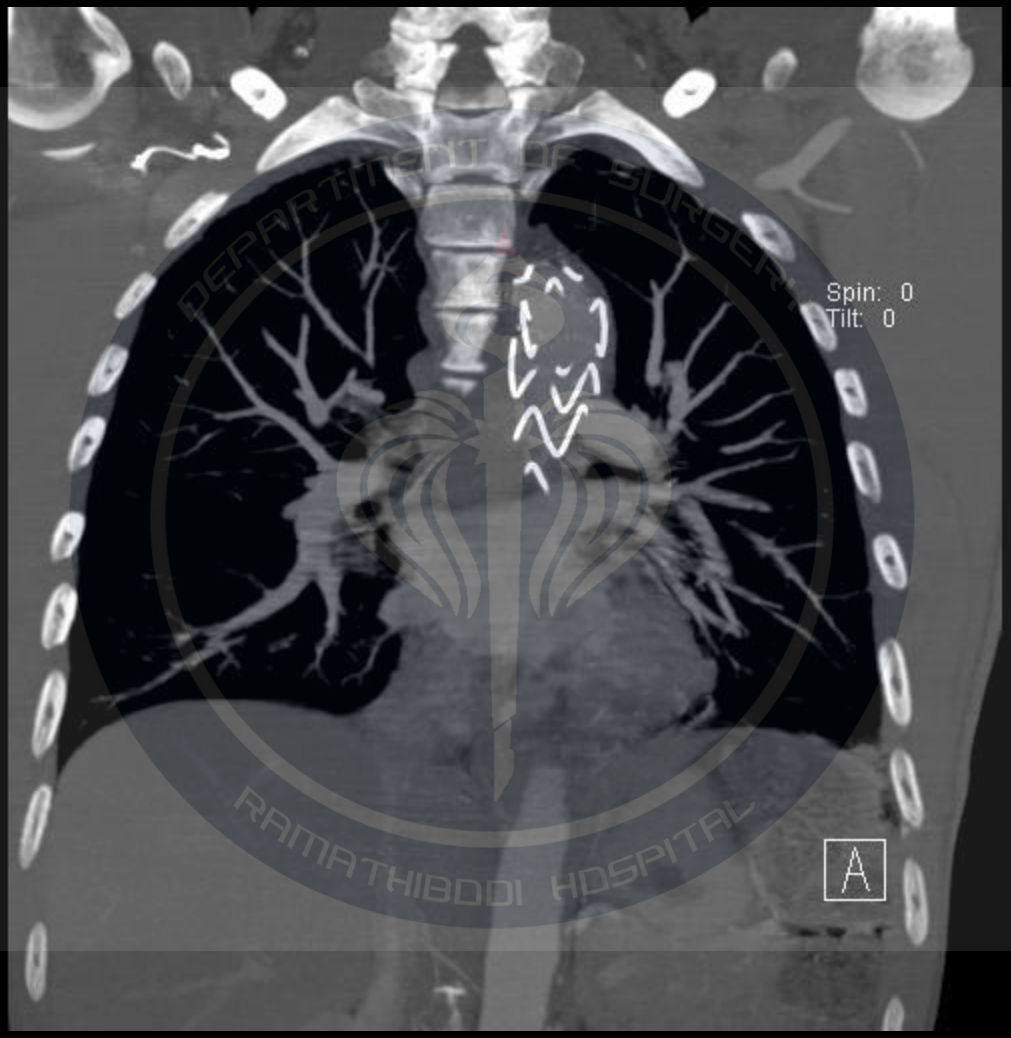
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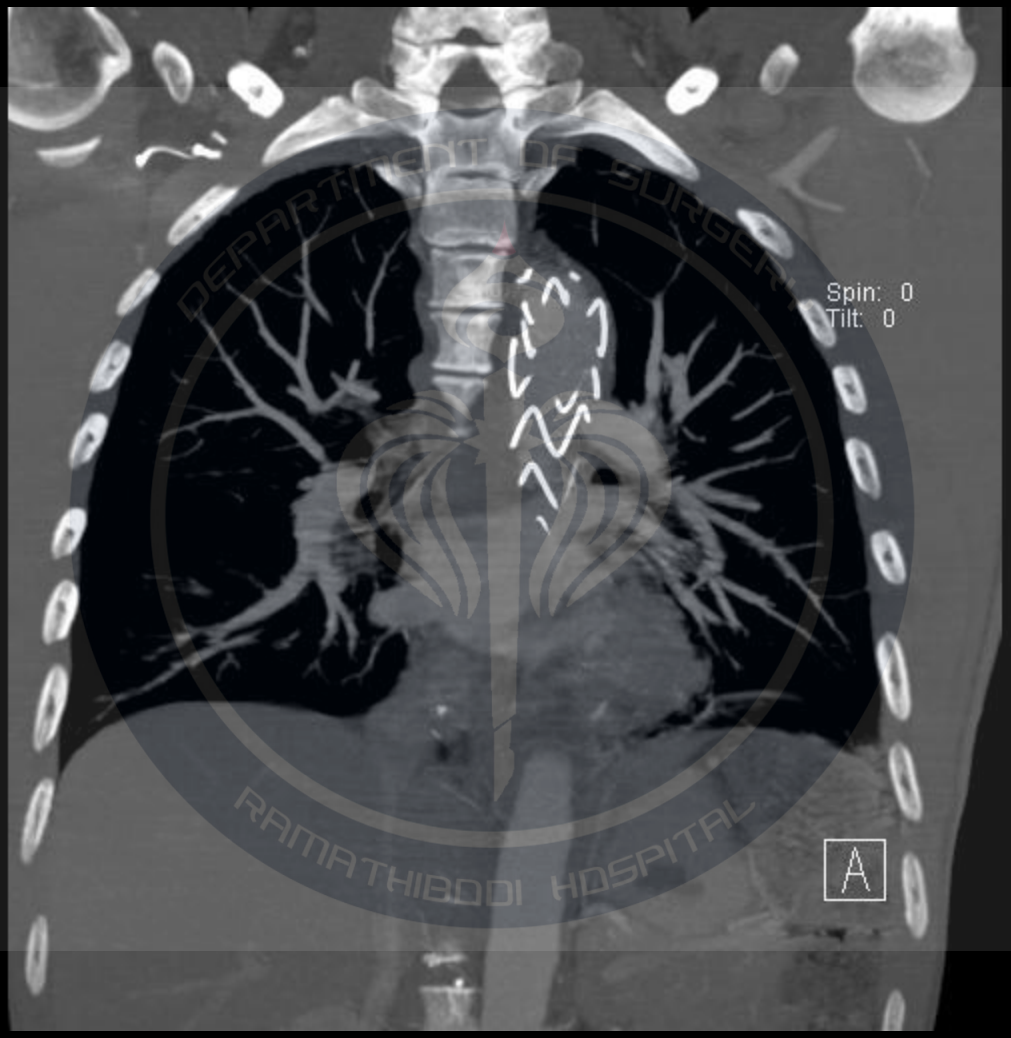
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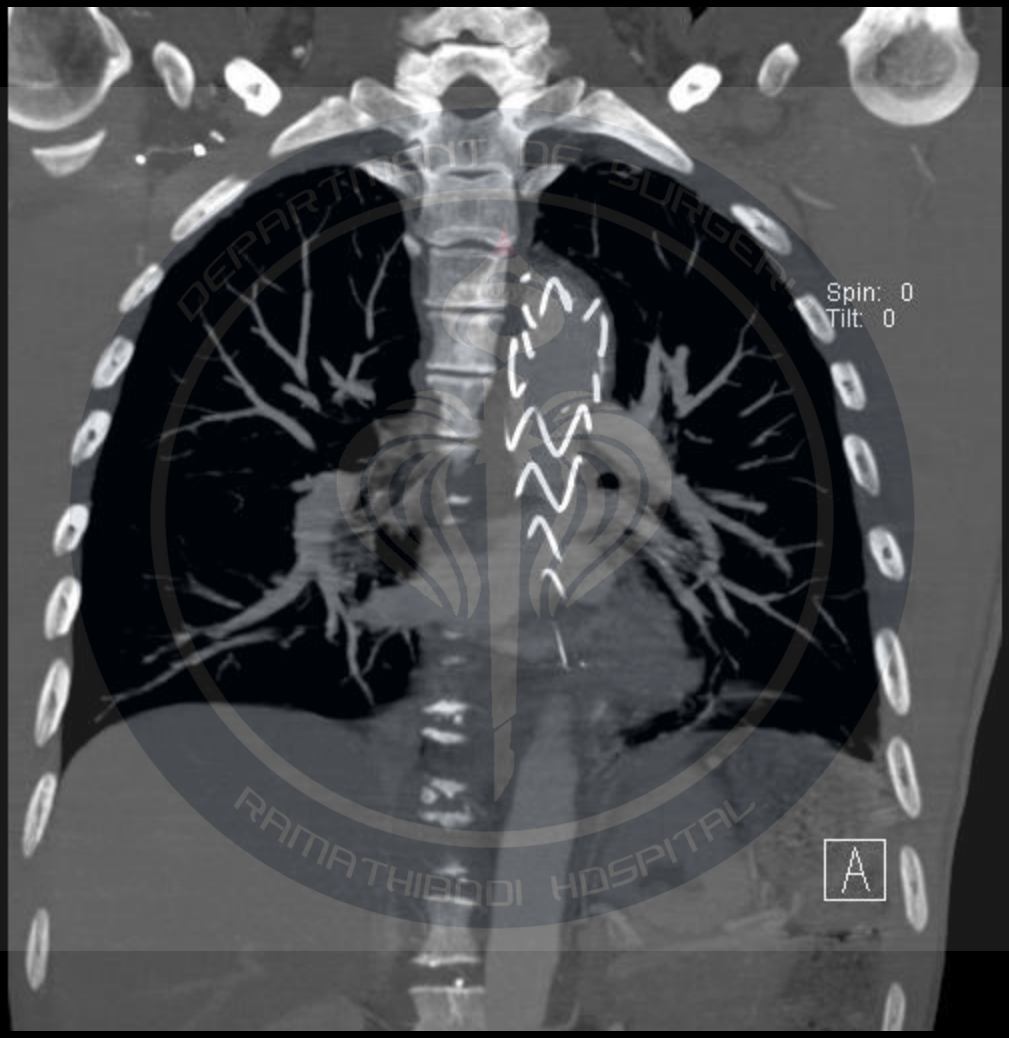
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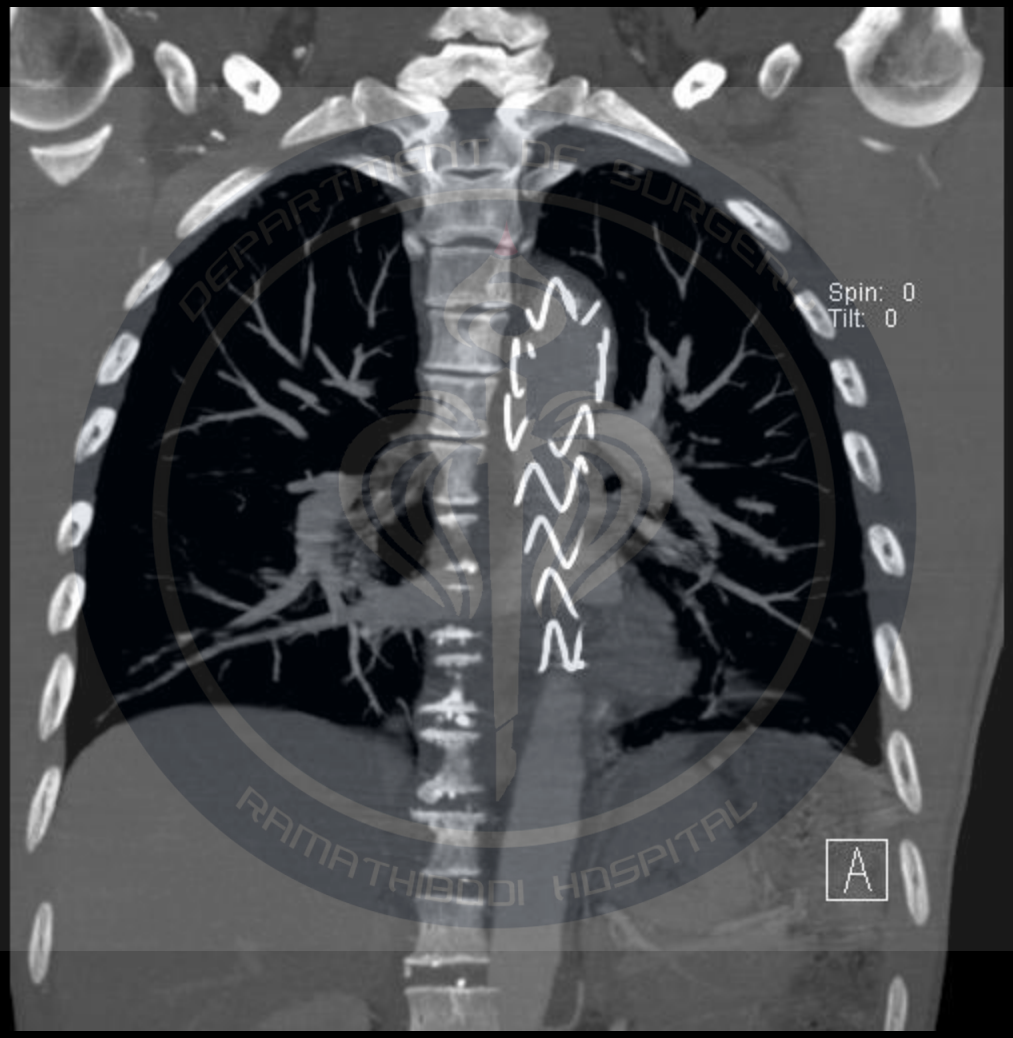
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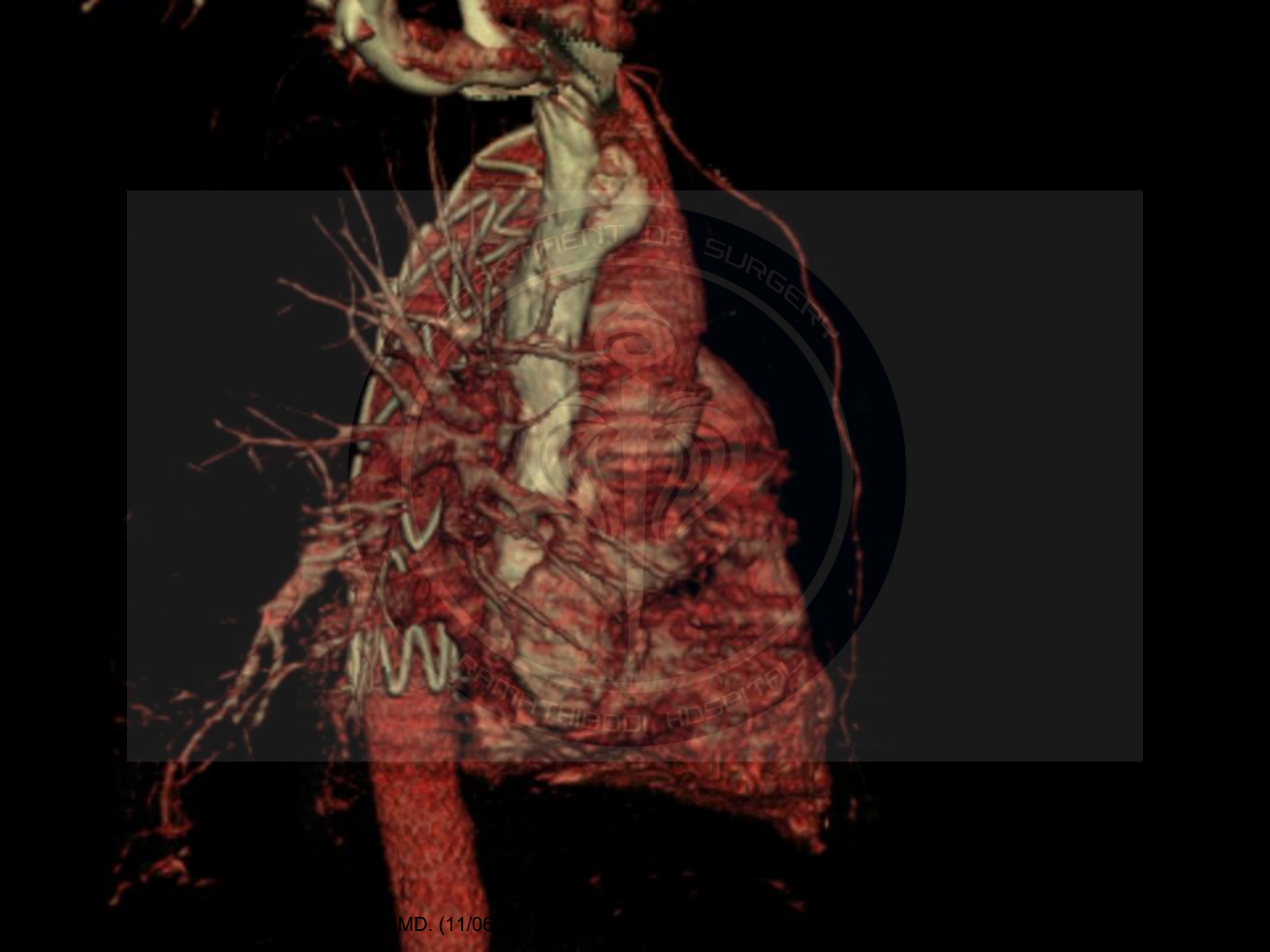
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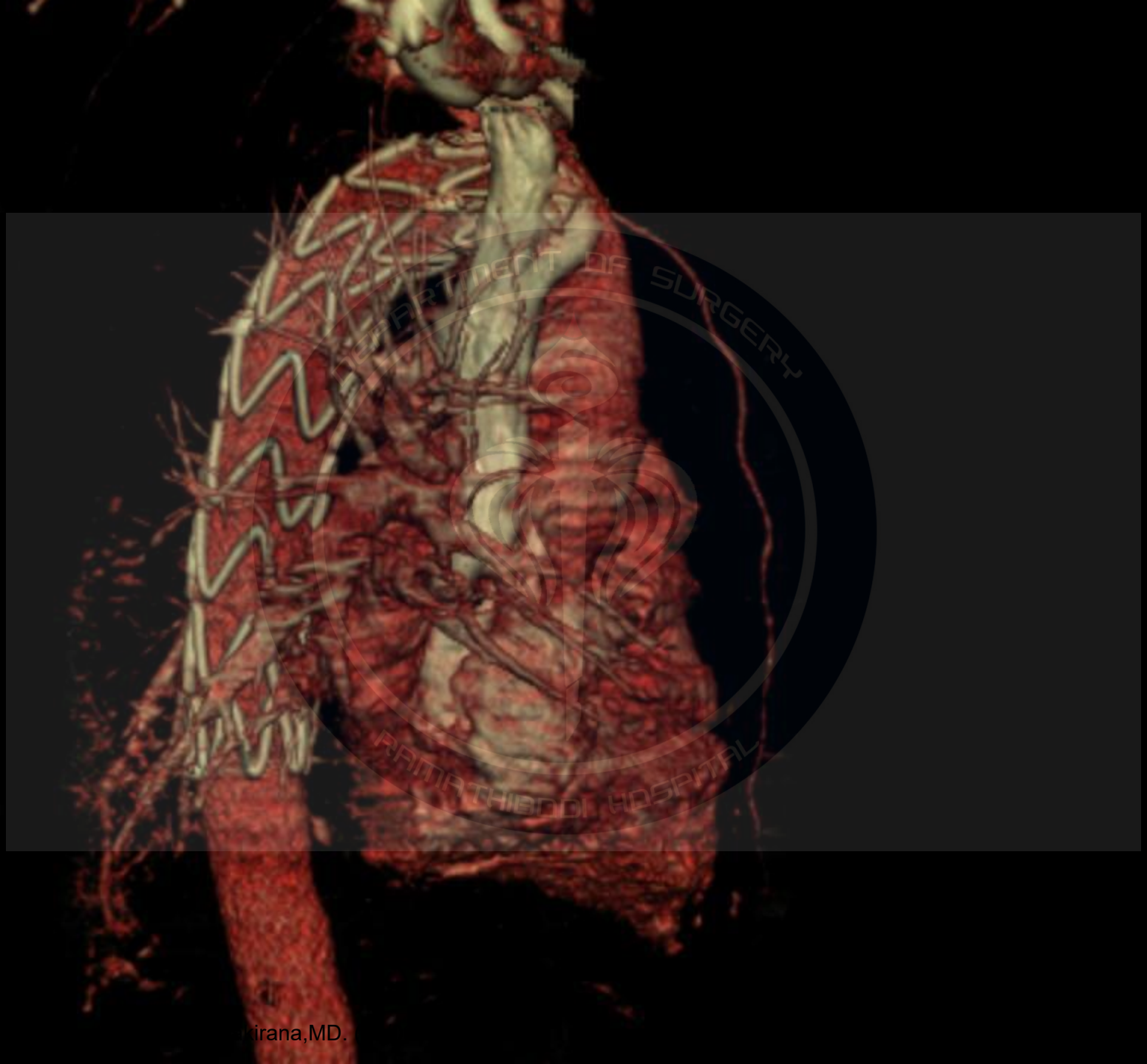
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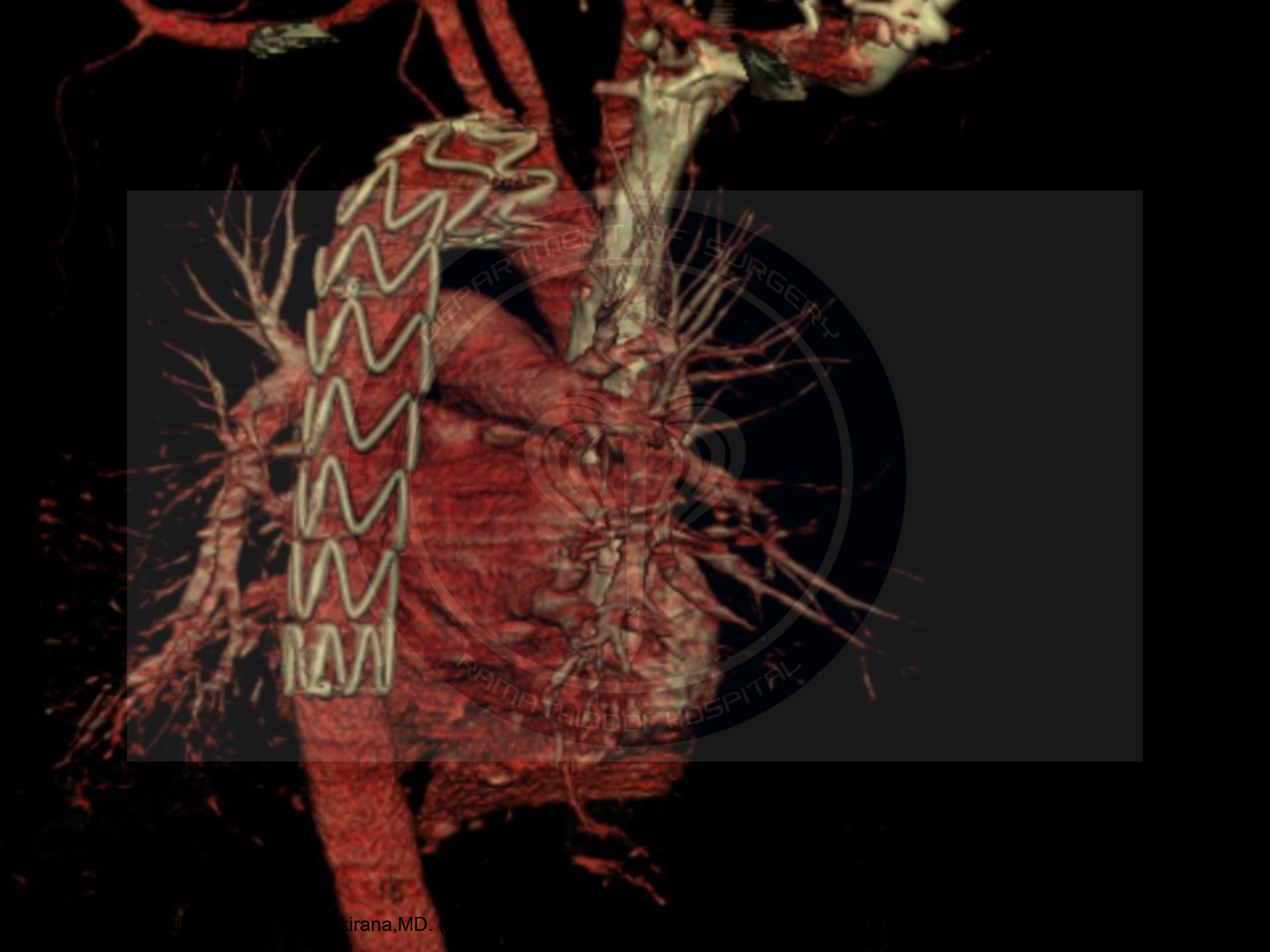
yakirana,M

yakirana,M



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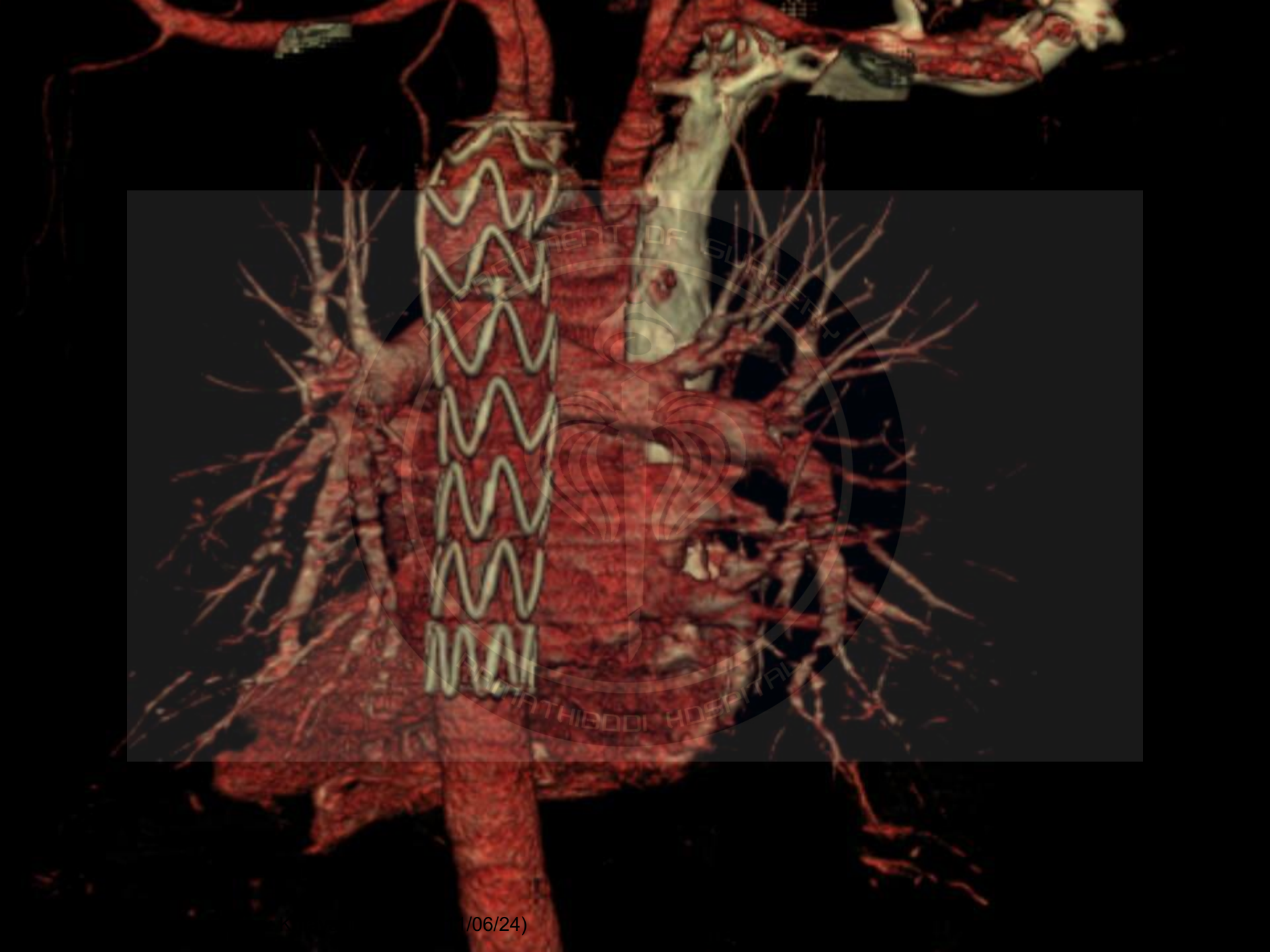

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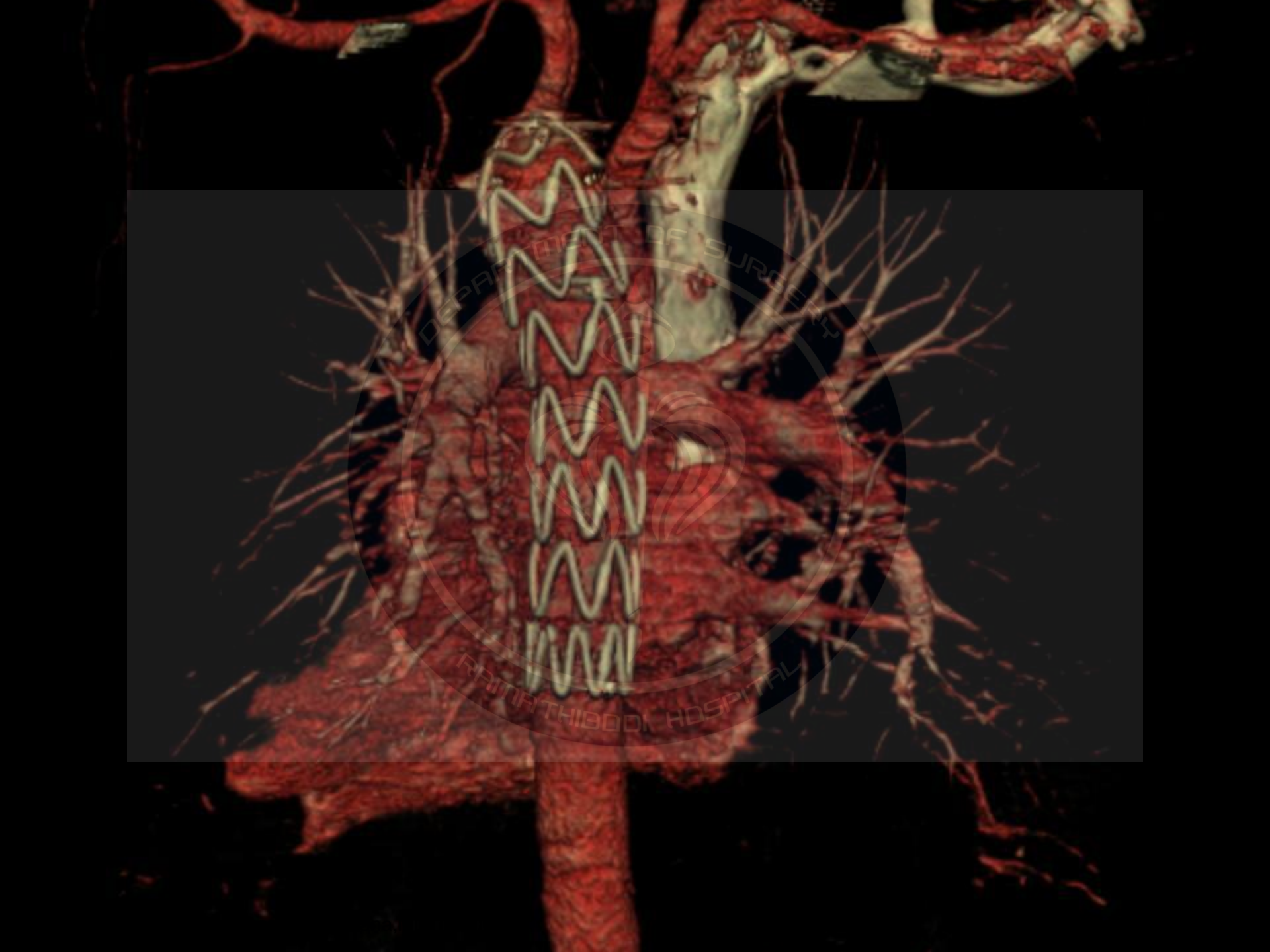

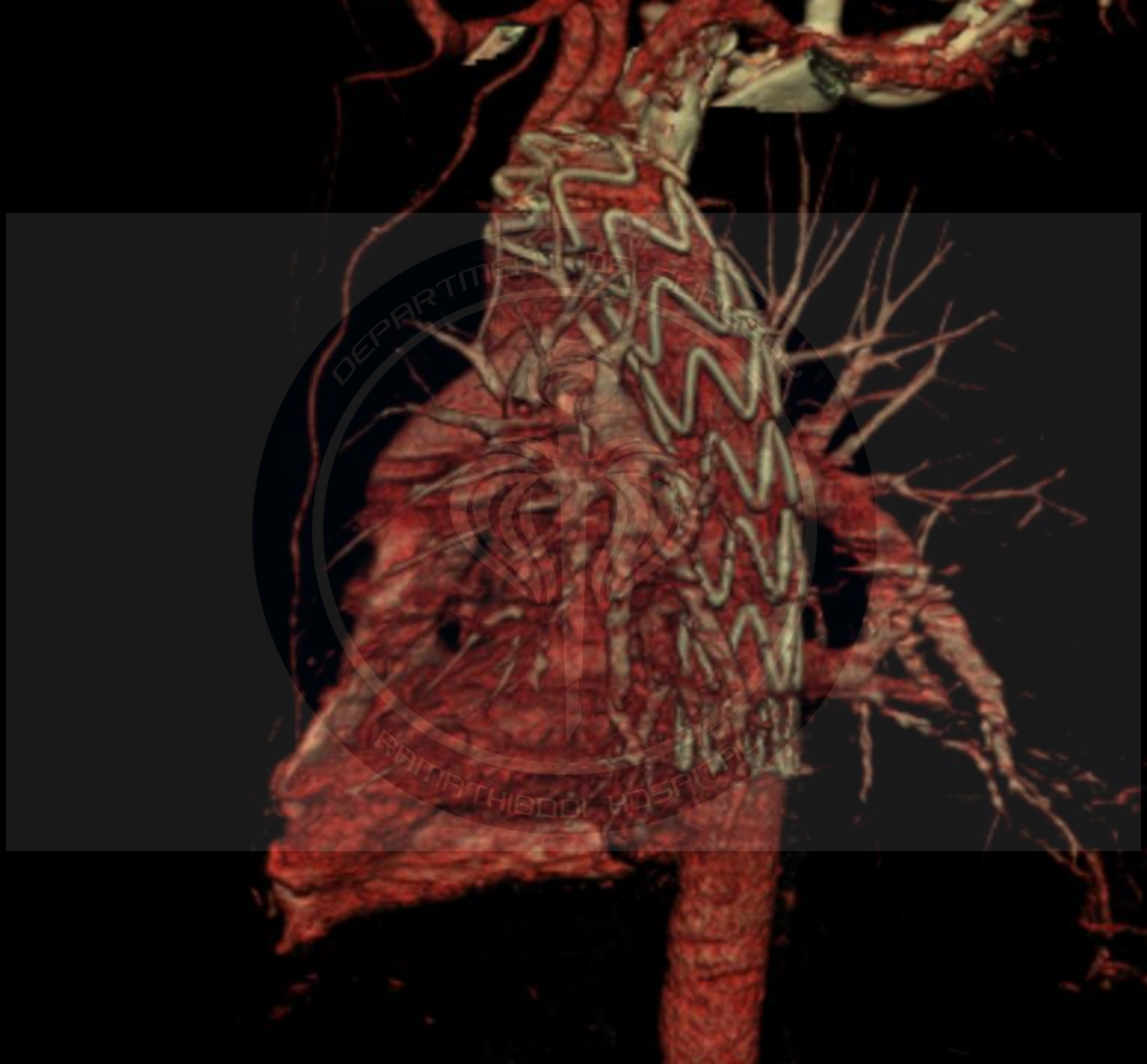

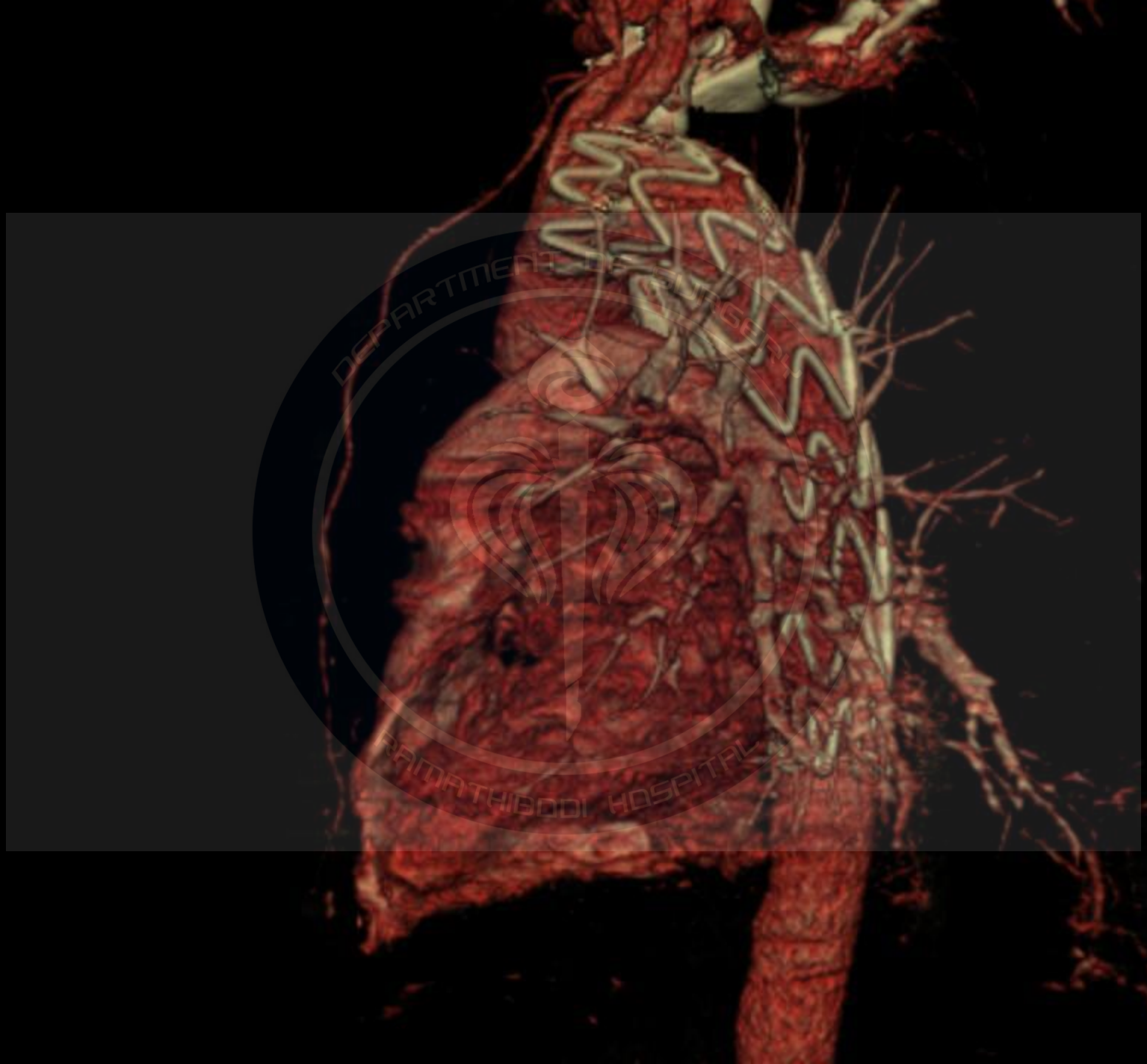


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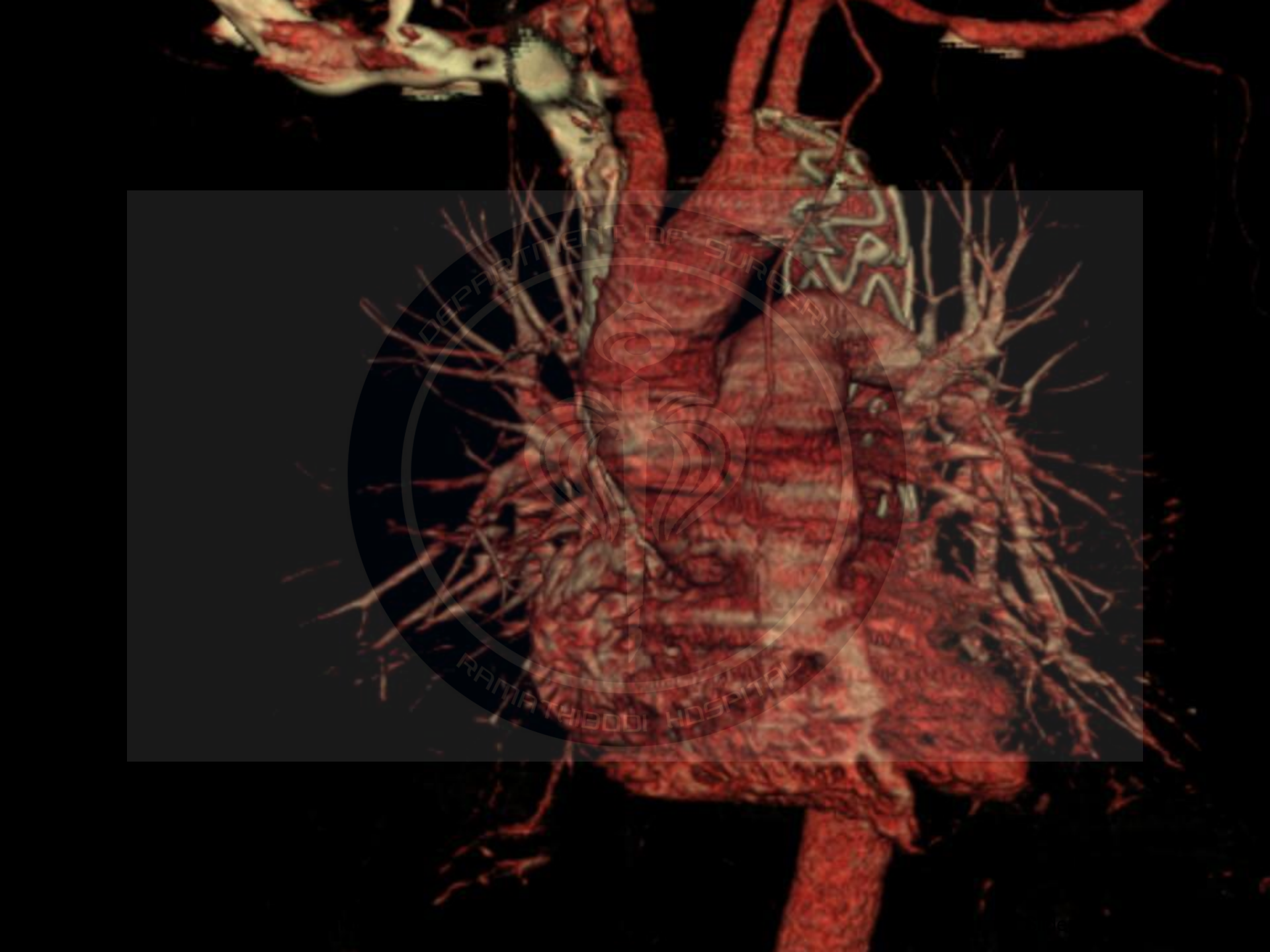

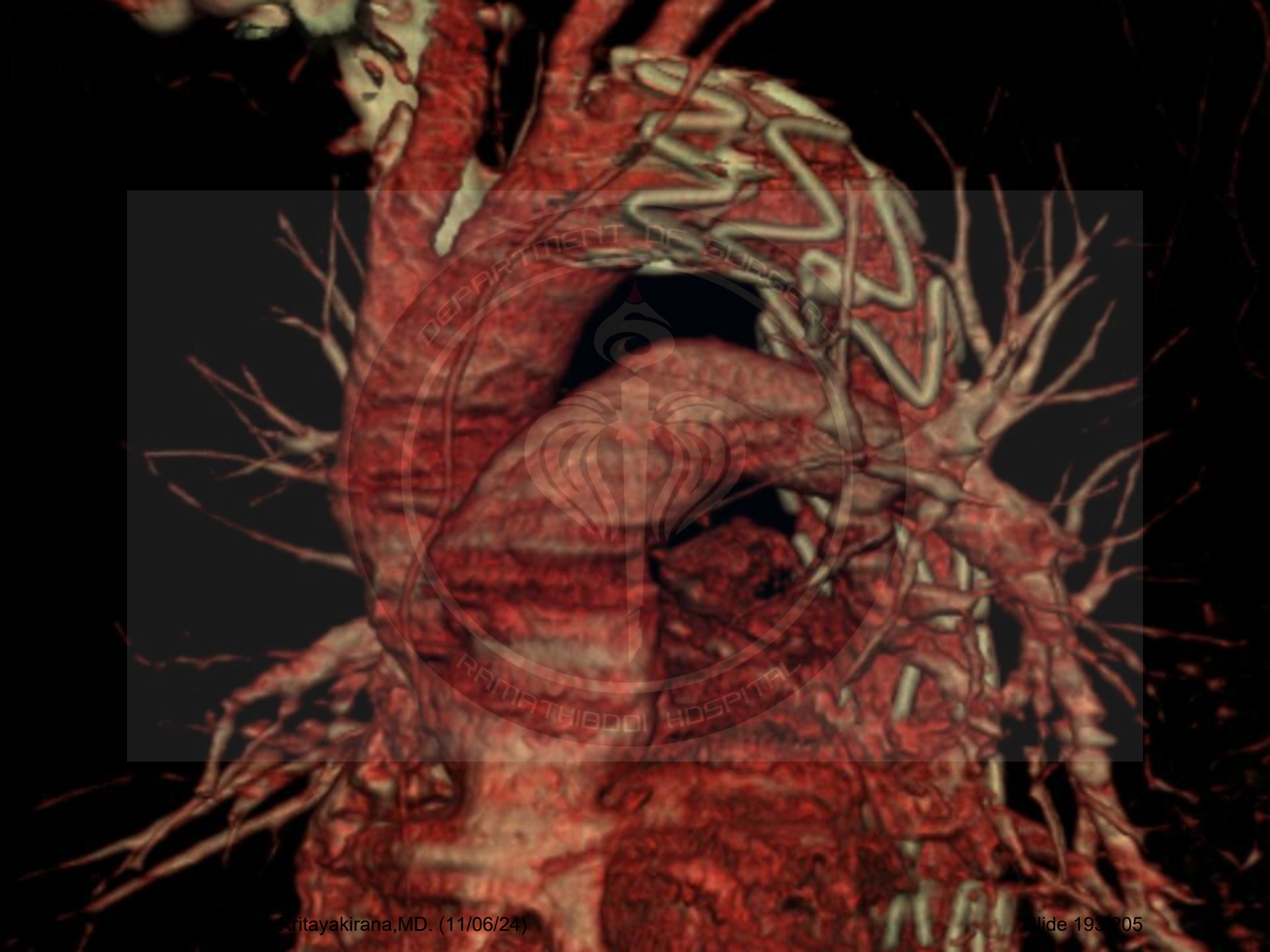


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Summary of Society of Thoracic Surgeons Recommendations for Thoracic Stent Graft Insertion

Entity/Subgroup	Classification	Level of Evidence
Penetrating ulcer/intramural hematoma		
Asymptomatic	III	C
Symptomatic	IIa	C
Acute traumatic	I	B
Chronic traumatic	IIa	C
Acute Type B dissection		
Ischemia	I	A
No ischemia	IIb	C
Subacute dissection	IIb	B
Chronic dissection	IIb	B
Degenerative descending		
>5.5 cm, comorbidity	IIa	B
>5.5 cm, no comorbidity	IIb	C
<5.5 cm	III	C
Arch		
Reasonable open risk	III	A
Severe comorbidity	IIb	C
Thoracoabdominal/Severe comorbidity	IIb	C

	AAST 1997	AAST 2007
Diagnosis	Aortogram	CTA
Time to repair	16.5 hr	54.6 hr
Open repair	100%	35%
By pass use	65%	84%
Mortality	22%	13%
Paraplegia	9%	1.6%
Graft complication	0.5%	18.4%

J Trauma. 2008:64:1415-1419

Evaluation and management of blunt traumatic aortic injury: A practice management guideline from the Eastern Association for the Surgery of Trauma

Nicole Fox, MD, Diane Schwartz, MD, Jose H. Salazar, MD, Elliott R. Haut, MD, Philipp Dahm, MD, James H. Black, MD, Scott C. Brakenridge, MD, John J. Como, MD, Kimberly Hendershot, MD, David R. King, MD, Adrian A. Maung, MD, Matthew L. Moorman, MD, Kimberly Nagy, MD, Laura B. Petrey, MD, Ronald Tesoriero, MD, Thomas M. Scalea, MD, *and* Timothy C. Fabian, MD

BACKGROUND: Blunt traumatic aortic injury (BTAI) is the second most common cause of death in trauma patients. Eighty percent of patients with BTAI will die before reaching a trauma center. The issues of how to diagnose, treat, and manage BTAI were first addressed by the Eastern Association for the Surgery of Trauma (EAST) in the practice management guidelines on this topic published in 2000. Since that time, there have been advances in the management of BTAI. As a result, the EAST guidelines committee decided to develop updated guidelines for this topic using the Grading of Recommendations, Assessment, Development and Evaluation (GRADE) framework recently adopted by EAST.

METHODS: A systematic review of the MEDLINE database using PubMed was performed. The search retrieved English language articles regarding BTAI from 1998 to 2013. Letters to the editor, case reports, book chapters, and review articles were excluded. Topics of investigation included imaging to diagnose BTAI, type of operative repair, and timing of operative repair.

RESULTS: Sixty articles were identified. Of these, 51 articles were selected to construct the guidelines.

CONCLUSION: There have been changes in practice since the publication of the previous guidelines in 2000. Computed tomography of the chest with intravenous contrast is strongly recommended to diagnose clinically significant BTAI. Endovascular repair is strongly recommended for

J Trauma Acute Care Surg. 2015 Jan;78(1):136-46.

Population Intervention Comparator Outcome

- In patients with suspected BTAI (P), should CT of the chest with intravenous contrast (I) be used versus conventional catheter-based angiography (C) for the identification of clinically significant BTAI (O)?

PICO question 1

- First, we strongly recommend CT of the chest with intravenous contrast for the identification of clinically significant BTAI.

Population Intervention Comparator Outcome

- In patients with BTAI (P), should endovascular (I) repair be performed versus open repair (C) to minimize risk of mortality, stroke, paraplegia, and renal failure (O)?

PICO question 2

- Second, we strongly recommend the use of endovascular repair in patients with BTAI who do not have contraindications to endovascular repair.

Population Intervention Comparator Outcome

- In patients with BTAI (P), should timing of repair be delayed (I) or immediate (C) to minimize risk of mortality, stroke, paraplegia, and renal failure (O)?

PICO question 3

- Finally, we suggest the use of delayed repair in patients with BTAI and emphasize that effective blood pressure control with antihypertensive medication must be used in these cases.