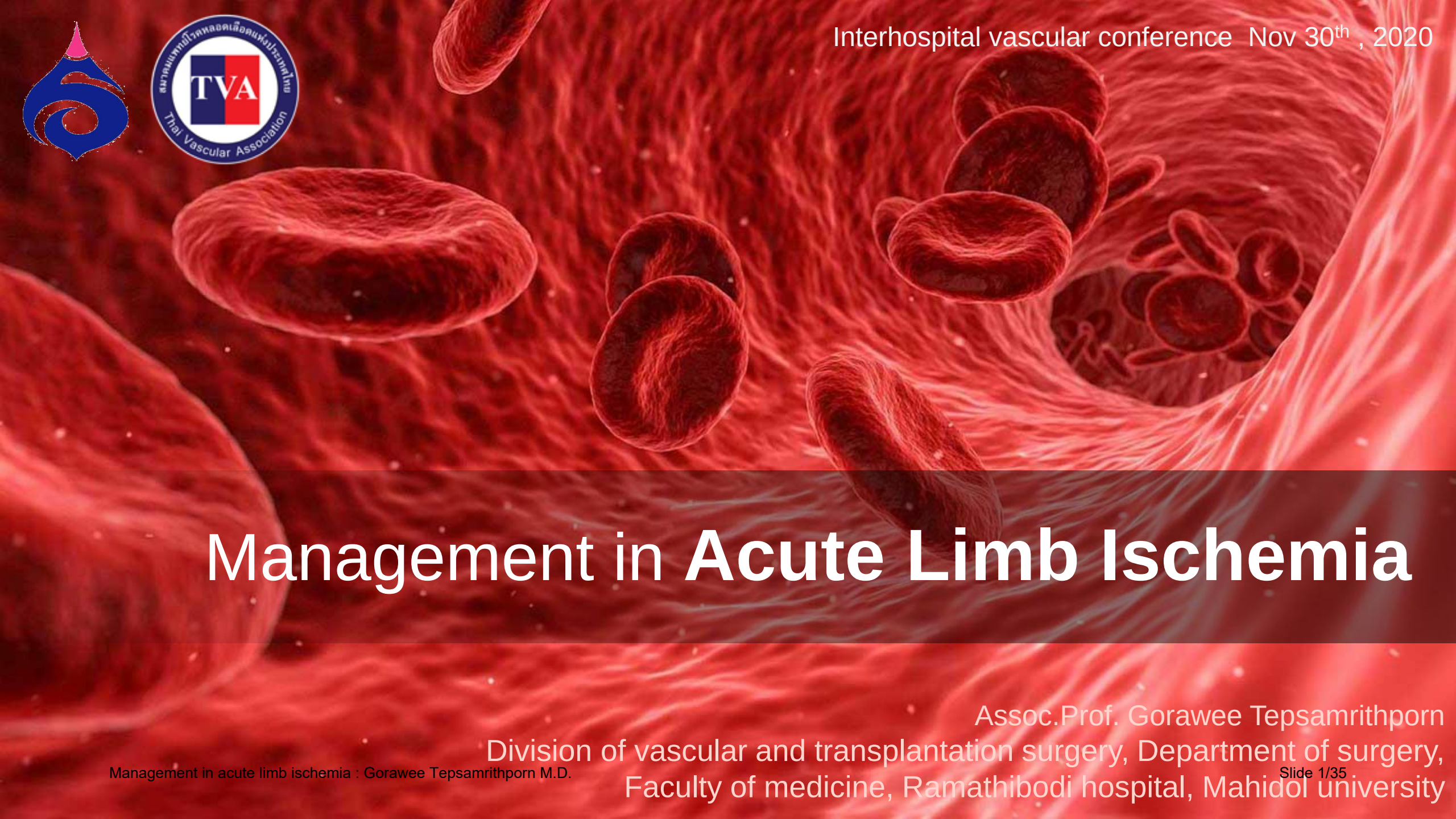

Interhospital vascular conference Nov 30th , 2020

Management in **Acute Limb Ischemia**

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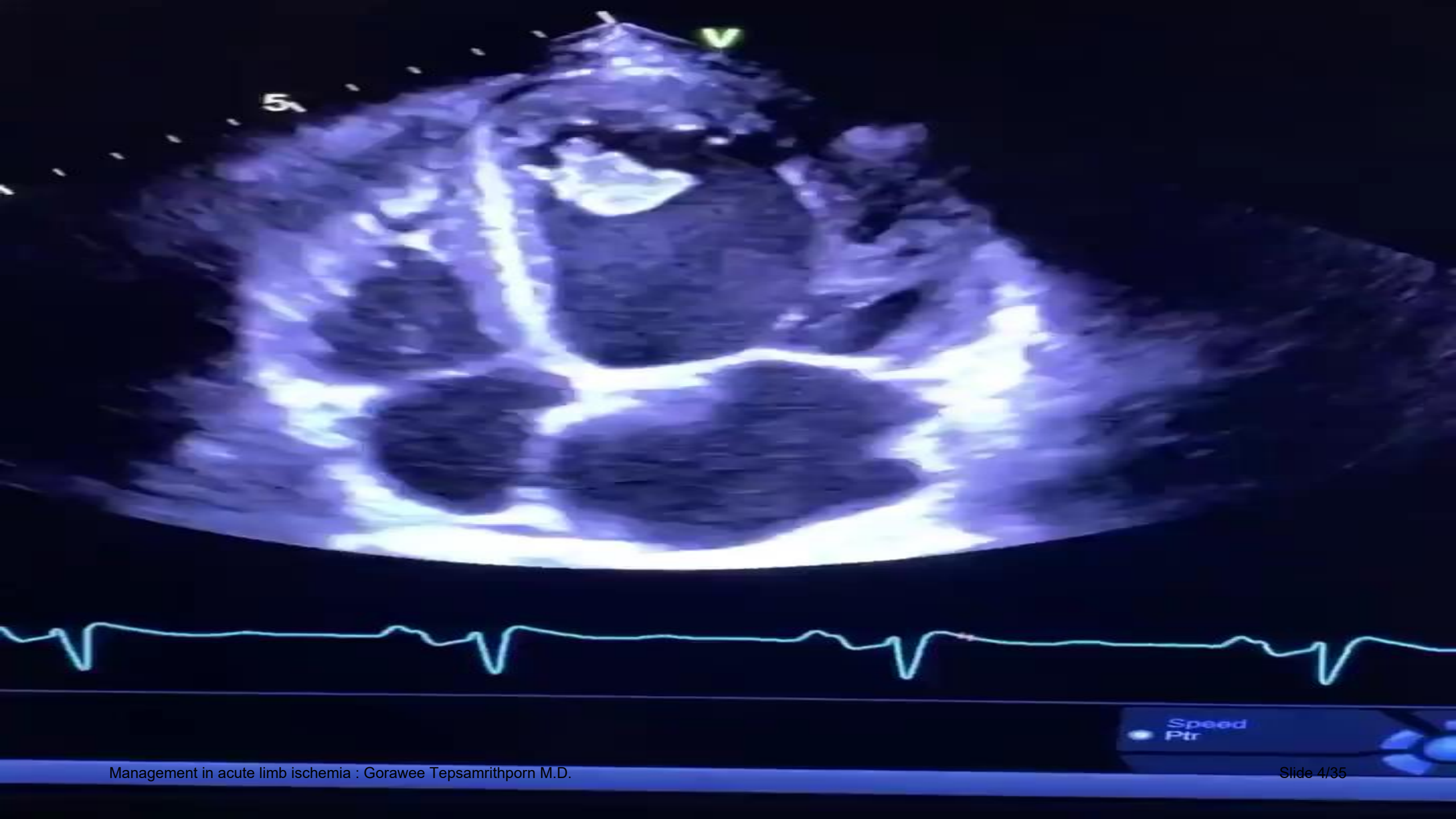
Disclosure

- Speaker name : Gorawee Tepsamrithporn
- I have the following potential conflicts of interest to report:
  - Consulting
  - Employment in industry
  - Stockholder of a healthcare company
  - Owner of a healthcare company
  - Other(s)
  - I do not have any potential conflict of interest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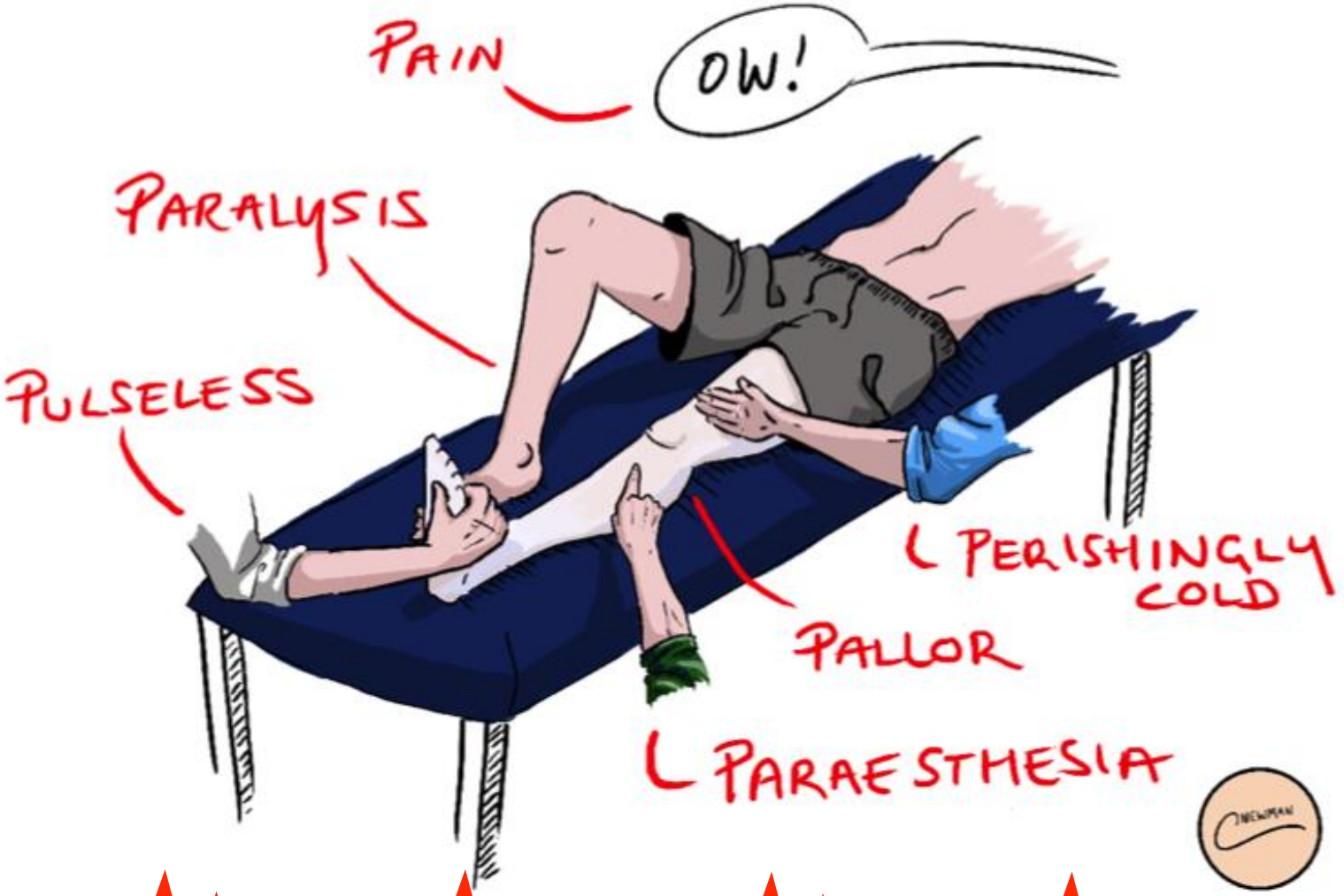

Table 1. Uncommon causes of acute limb ischaemia[10–12]

Cause	Pathology	Signs to look for
Vasculitis	Inflammation of the arteries	Bilateral disease. Systemic symptoms (e.g., fever). Signs of connective tissue disease.
Popliteal entrapment syndrome	The popliteal artery is compressed by muscle or tendon during plantar flexion	Young active patient, no atherosclerotic risk factors. History of claudication pain.
Adventitial cystic disease	Cyst in the vessel wall, occluding blood flow	Acute arterial thrombosis (usually popliteal) in a young person. No atherosclerotic risk factors.
Paradoxical embolism	Atrial septal defect, venous thrombo-embolism (often with pulmonary hypertension)	Venous thrombo-embolism, cardiac bruit, and pulmonary embolism
Tumour embolism	Tissue like embolic material	Signs of tumour or malignancy (usually advanced) in heart or lung
Acute compartment syndrome	Swelling of tissues within fascial compartment (especially the anterior compartment of leg) compressing arteries	History of revascularisation or prolonged surgery. Pain on passive movement
Foreign body embolisation	Gangrene in multiple fingers or toes, often associated with infection or intravenous drug use	Intravenous drug users
Thrombophilia	Arterial thrombosis without risk factors	Young patients, often with a family history
Low cardiac output syndromes	Low blood flow to the extremities, worsened by devices. Common causes: hypotension, shock, and sepsis	Patients with severe cardiac failure, intra-aortic pump devices, extracorporeal membrane oxygenation (ECMO)

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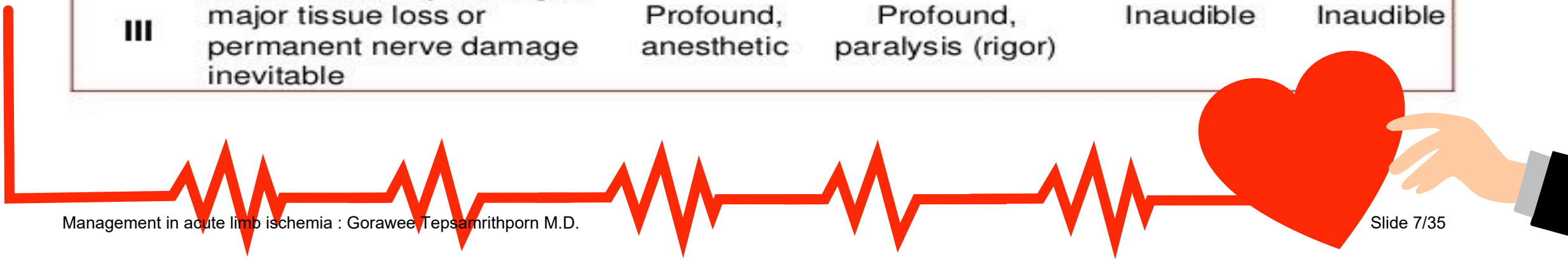
Stages of Acute Limb Ischemia

Stage	Description and Prognosis	Findings		Doppler Signal	
		Sensory Loss	Muscle Weakness	Arterial	Venous
I	Limb viable, not immediately threatened	None	None	Audible	Audible
II	Limb threatened				
IIa	Marginally threatened, salvageable if	Minimal (toes) or none	None	Often inaudible	Audible
IIb	Immediately threatened, salvageable with immediate revascularization	More than toes, associated	Mild or moderate	Usually inaudible	Audible
III	Limb irreversibly damaged, major tissue loss or permanent nerve damage inevitable	Profound, anesthetic	Profound, paralysis (rigor)	Inaudible	Inaudible



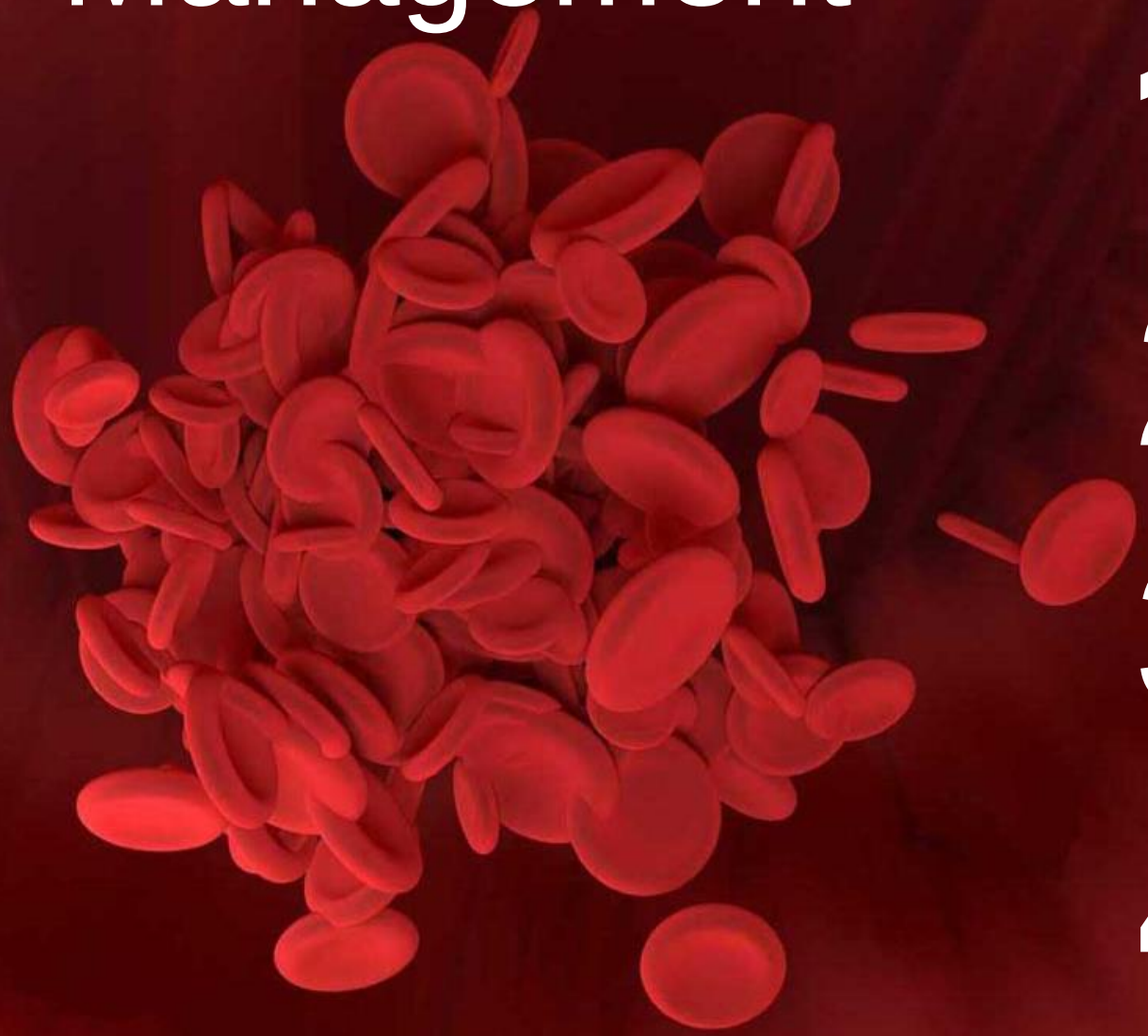
Decision making in ALI

*'A larger ,potentially more hazardous surgical procedure has a **greater predicted chance of success** , but also a greater risks of **complications ,including death**"*

Decision making in ALI

Diagnosis of ALI	**History taking and PE**
Level of occlusion	**Physical examination**
Severity of ischemia	**Rutherford classification**
Cause of ischemia	**Thrombosis / Embolism**
Patient status and underlying disease	

Management



1 **Initial medication**

Systemic heparinization (IC) and appropriate analgesia (IC)

2 **Additional management**

intravenous hydration and supplementary oxygen (IC) and lowering the foot end of the bed (anti-Trendelenburg position)

3 **Preop. Evaluation**

Myoglobin , CK : subsequent resuscitative support
Cardiac troponin , CRP , neutrophil / lymphocyte ration : no conclusion

4 **Revascularization**

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Treatment options

Open surgery

Endovascular treatment

Hybrid treatment

Principle of Treatment

- Clearing the thrombus
- Correcting underlying lesion
- Prevent recurrent ischemia
- Combat against reperfusion syndrome and compartment syndrome

Open revascularization

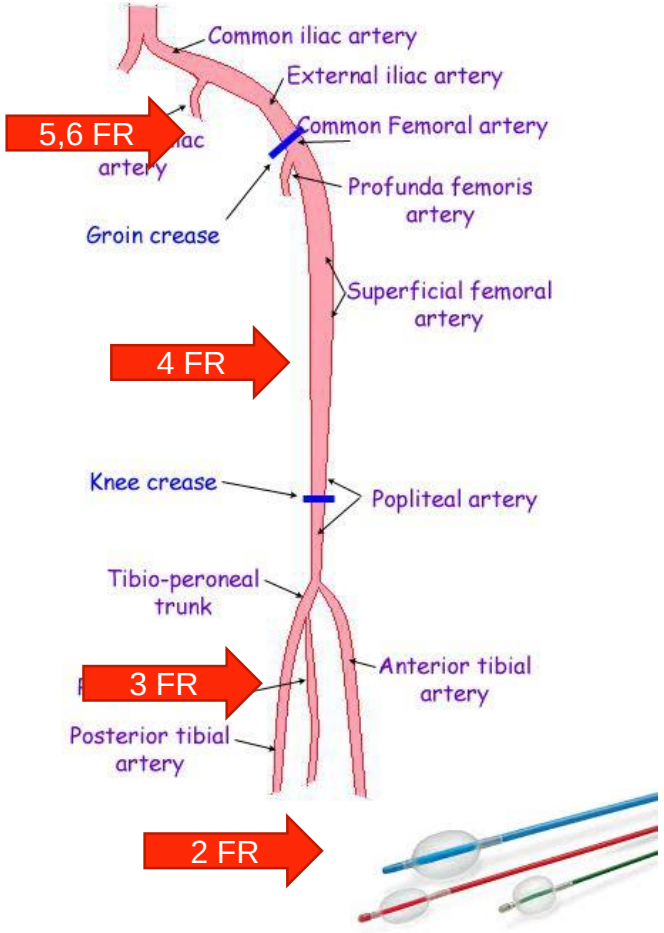
Clearing the thrombus

- Thrombo-embolectomy with appropriate size of Fogarty catheter(+/- OTW) and proper technique
- Completion angiography (IC)

Correcting underlying lesion

- Endarterectomy : insitu occlusion of CFA
- Bypass surgery

Consider fasciotomy



Management in acute limb ischemia : Gorawee Tepsamrithporn M.D.

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Kwolek CJ. In Rutherford's vascular surgery and endovascular therapy, 9th ed. Philadelphia. Elsevier Saunders.2019.1326-43

Open surgery

Balloon catheter embolectomy or thrombectomy

What can I do if the angiogram showed not complete removal all clot?

Embolectomy at the site to the location of thrombus (infragenicular late popliteal a)

How I do it ?
Thrombo-embolectomy

Docquity Rerun

Two balloon technique

Forgarthy over the wire

SIDAWY A N . In Rutherford's vascular surgery and endovascular therapy, 9th ed. Philadelphia. Elsevier Saunders.2019.1326-43

Endovascular revascularization

Advantage

- Minimally invasive approach
- Restore blood flow to the extremity
- Allow the identification culprit lesions
- Low-pressure reperfusion

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Endovascular revascularization

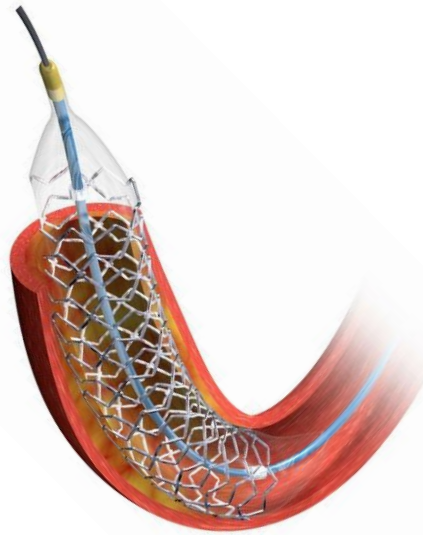
Clearing the thrombus

- Many techniques and equipments

Correcting underlying lesion

- Balloon angioplasty +/- stenting

Consider fasciotomy



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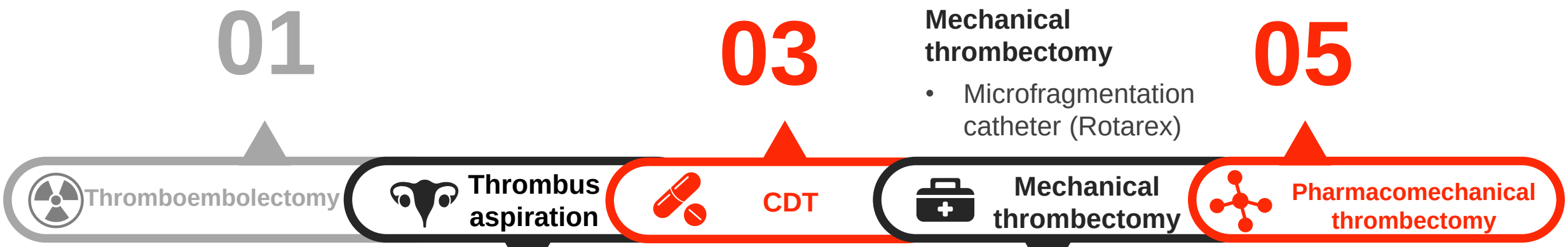
Clearing the thrombus



Thrombus aspiration

- Simple large bore catheter (guiding) with vacuum syringe
- Commercial aspiration pump (Penumbra)

Catheter Directed Thrombolysis

Thrombolytic agent
Multiple side hole catheter.

Mechanical thrombectomy

- Microfragmentation catheter (Rotarex)

Pharmacomechanical thrombectomy

Reolytic

- AngioJet rheolytic thrombectomy system (AngioJet)
- Pharmacomechanical thrombolysis-thrombectomy (IPMT) system(Trellis)

Ultrasound enhance
(EkoSonic Endovascular System).

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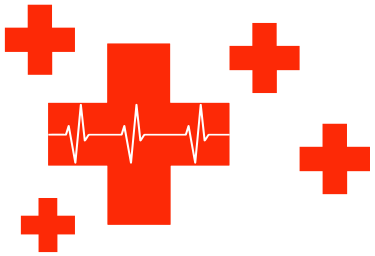
Clearing the thrombus



Catheter directed thrombolysis

Allow the identification culprit lesions

Low-pressure reperfusion

Time consume

Distal embolization

Bleeding complications

Mechanical thrombectomy

Decreasing delay to reperfusion

no thrombolytic dose

In contraindication for thrombolysis patients

Shorten the time to reperfusion

Distal embolization

Perforation

Pharmacomechanical thrombectomy

Decrease in the dose of lytic agents

Decrease duration of thrombolysis

Minimize the bleeding risk asso. with standard CDT

Shorten the time to reperfusion

Distal emboli

Hemoglobinemia and hemoglobiuria

Primary open surgery or thrombolysis for acute limb ischemia?

Table 6. Randomised controlled trials comparing thrombolysis with surgical revascularisation

Reference	Patients *n*	Thrombolytic agent	Amputation free survival at one year *n* (%)	Major bleeding at 30 days *n* (%)	Stroke at 30 days *n* (%)	Distal embolisation at 30 days *n* (%)
Nilsson *et al.* (1992)[160]	20	High dose rtPA; 30 mg/3 h continuous UFH	NR	0 *vs.* 0	0 *vs.* 0	1/11 *vs.* 0/9 (0)
Ouriel *et al.* (1994)[161]	114	High dose rtPA; 30 mg/3 h continuous UFH	*vs.* 30/57 (53)*	*vs.* 1/57 (2)	*vs.* 0/57 (0)	*vs.* 0/57 (0)*
Ouriel *et al.* (1996)[301]	213	Urokinase; continuous UFH	107/155 (69) *vs.* 38/58 (66)	*vs.* 17/58 (30)	3/155 (1.9) *vs.* 0/58 (0)	NR
Ouriel *et al.* (1998)[159]	544	Urokinase; continuous UFH	177/272 (65.1) *vs.* 191/272 (70.2)	32/272 (11.8) *vs.* 14/272 (5.1)*	4/272 (1.5) *vs.* 0/272 (0)*	36/272 (13.2) *vs.* 0/272 (0)*
The STILE trial (1994)[91]	393	High dose rtPA; 0.05 mg/kg/h or urokinase continuous UFH	NR	14/249 (5.6) *vs.* 1/144 (0.7)*	3/249 (1.2) *vs.* 0/144 (0)	NR

local intraarterial thrombolysis and surgery were equivalent treatment options for ALI in terms of amputation free survival up to 1yr

Data are *n* (%) unless otherwise stated. rtPA = recombinant tissue plasminogen activator; UFH = unfractionated heparin; NR = not reported.

* Significant difference.

† Need of blood transfusion.

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Endovascular

Pharmacological catheter-directed thrombolysis (CDT)

Cochrane Library

Cochrane Database of Systematic Reviews

Surgery versus thrombolysis for initial management of acute limb ischaemia (Review)

No clear differences at 30 days , 6 mo, 1 yr

- Limb salvage (OR1.02, 95% CI 0.41-2.55)
- Amputation (OR 0.97, 95% CI 0.51-1.85)
- Death (OR 0.59, 95% CI 0.31-1.14)

Darwood R. Cochrane Database of Systematic Reviews 2018, Issue 8. Art. No.: CD002784.

Endovascular

Pharmacological catheter-directed thrombolysis (CDT)

Cochrane Library

Cochrane Database of Systematic Reviews

Surgery versus thrombolysis for initial management of acute limb ischaemia (Review)

Complication: associated with thrombolysis treatment at 30 days

- **Major haemorrhage** (OR 3.22, 95% CI 1.79-5.78)
- **Distal embolisation** (OR 31.68, 95% CI 6.23-161.07)
- No clear difference in stroke (OR 5.33, 95% CI 0.95-30.11)

Earnshaw JJ. Cochrane Database of Systematic Reviews 2018, Issue 8. Art. No.: CD002784.

Hybrid revascularization

- ☑ trend to have complex, multilevel occlusive disease
- ☑ Thrombolysis complication

Clearing the thrombus

- Thromboembolectomy +/- intraoperative thrombolysis
- Aspiration / mechanical +/- pharmacological thrombectomy

Correcting underlying lesion

- Balloon angioplasty +/- stenting

Consider fasciotomy

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Hybrid procedure

Intraoperative isolated limb thrombolysis

rt-PA 2-8 mg

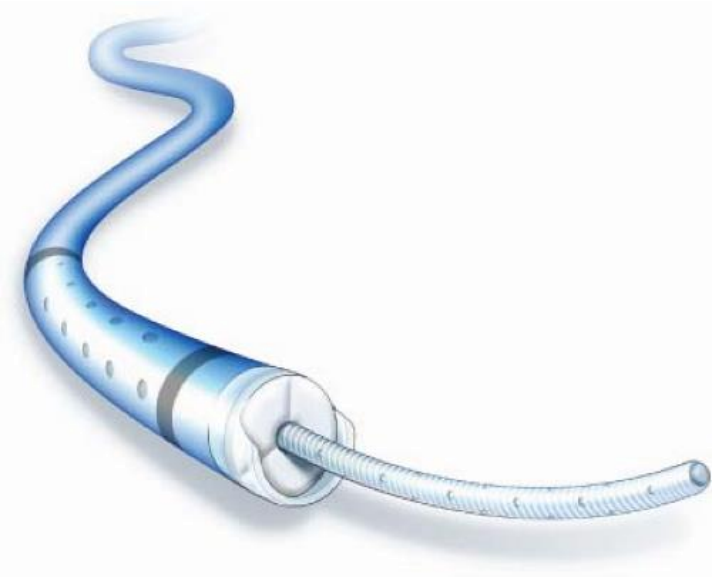
+

NSS (adequate for vascular bed)
15-50 cc

Wait for 15-30 min

Angiography

Repeatable if residual clot



Comerota AJ. Semin Vasc Surg 22:47-51.2009

Treatment

R

Class I	Class IIA	Class IIB	Class III
Best medical management	Heparinization	Heparinization	Heparinization
CDT : not recommend	CDT : alternative to sx	CDT : if promptly and combine with aspiration or mechanical thrombectomy	
	Mechanical thrombectomy	Mechanical thrombectomy	
	Phamacomechanical thrombectomy	Phamacomechanical thrombectomy	
	Open: embolectomy, bypass, endarterectomy, hybrid	Open: embolectomy, bypass, endarterectomy, hybrid	amputation

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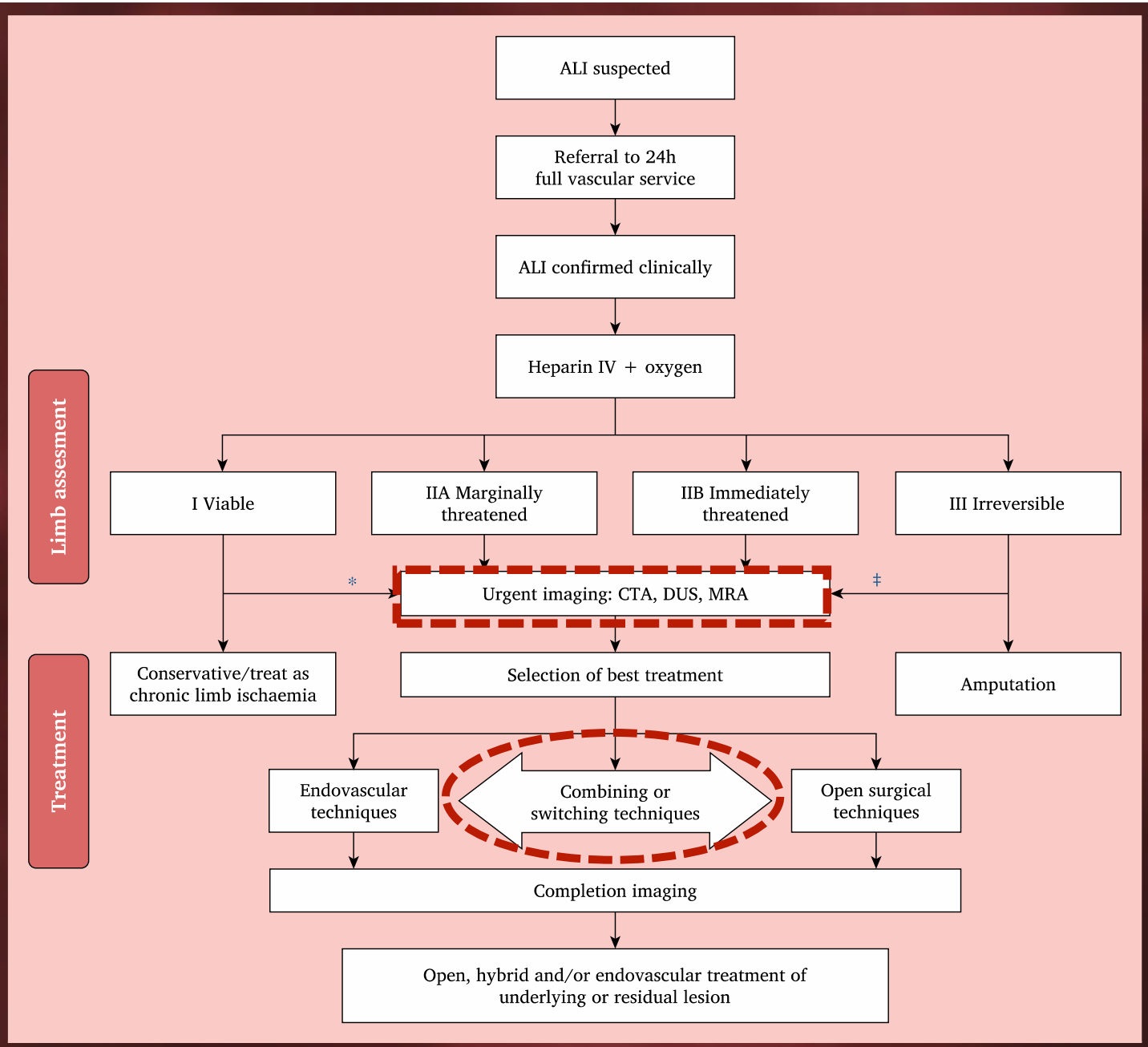
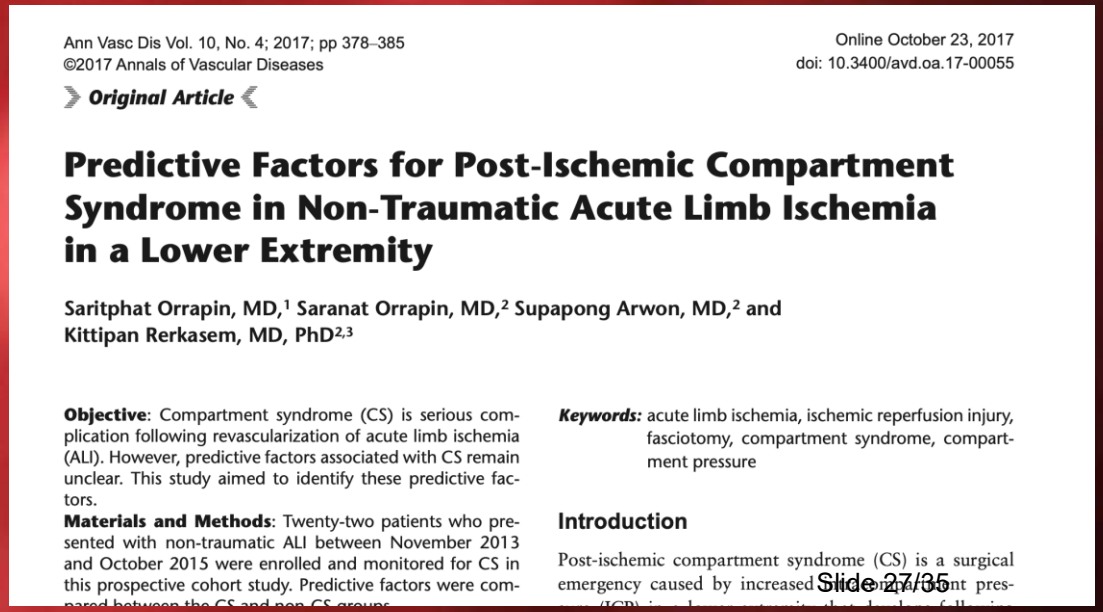


Compartment syndrome

Compartment pressure > 20-30 mmHg (sensitvity and specificity 94-98%)

Risk factor

- Ischemic duration >6 hr
- Young age
- Previous history of ALI
- Hypotension
- Rutherford IIb
- Inadequate intraoperative backflow
- Positive fluid balance



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doi: 10.3400/avd.oa.17-00055

Original Article

Predictive Factors for Post-Ischemic Compartment Syndrome in Non-Traumatic Acute Limb Ischemia in a Lower Extremity

Saritphat Orrapin, MD,[1] Saranat Orrapin, MD,[2] Supapong Arwon, MD,[2] and Kittipan Rerkasem, MD, PhD[2,3]

Objective: Compartment syndrome (CS) is serious complication following revascularization of acute limb ischemia (ALI). However, predictive factors associated with CS remain unclear. This study aimed to identify these predictive factors.
Materials and Methods: Twenty-two patients who presented with non-traumatic ALI between November 2013 and October 2015 were enrolled and monitored for CS in this prospective cohort study. Predictive factors were compared between the CS and non-CS groups.

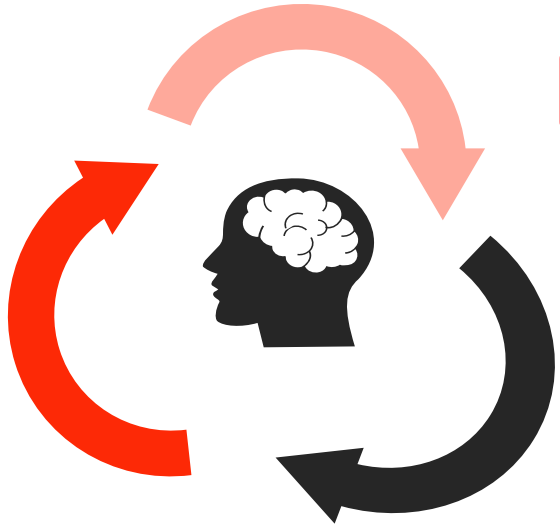
Keywords: acute limb ischemia, ischemic reperfusion injury, fasciotomy, compartment syndrome, compartment pressure

Introduction

Post-ischemic compartment syndrome (CS) is a surgical emergency caused by increased [illegible] pres-

Conclusion

Factors determine the treatment option



PATIENT
Age
fitness
Overall medical conditions

DISEASE
Severity of ischemia
Duration of ischemia
Location of ischemia
Cause of ischemia

FACILITY
Surgeon preference
Endovascular skill
Equipment and ICU care

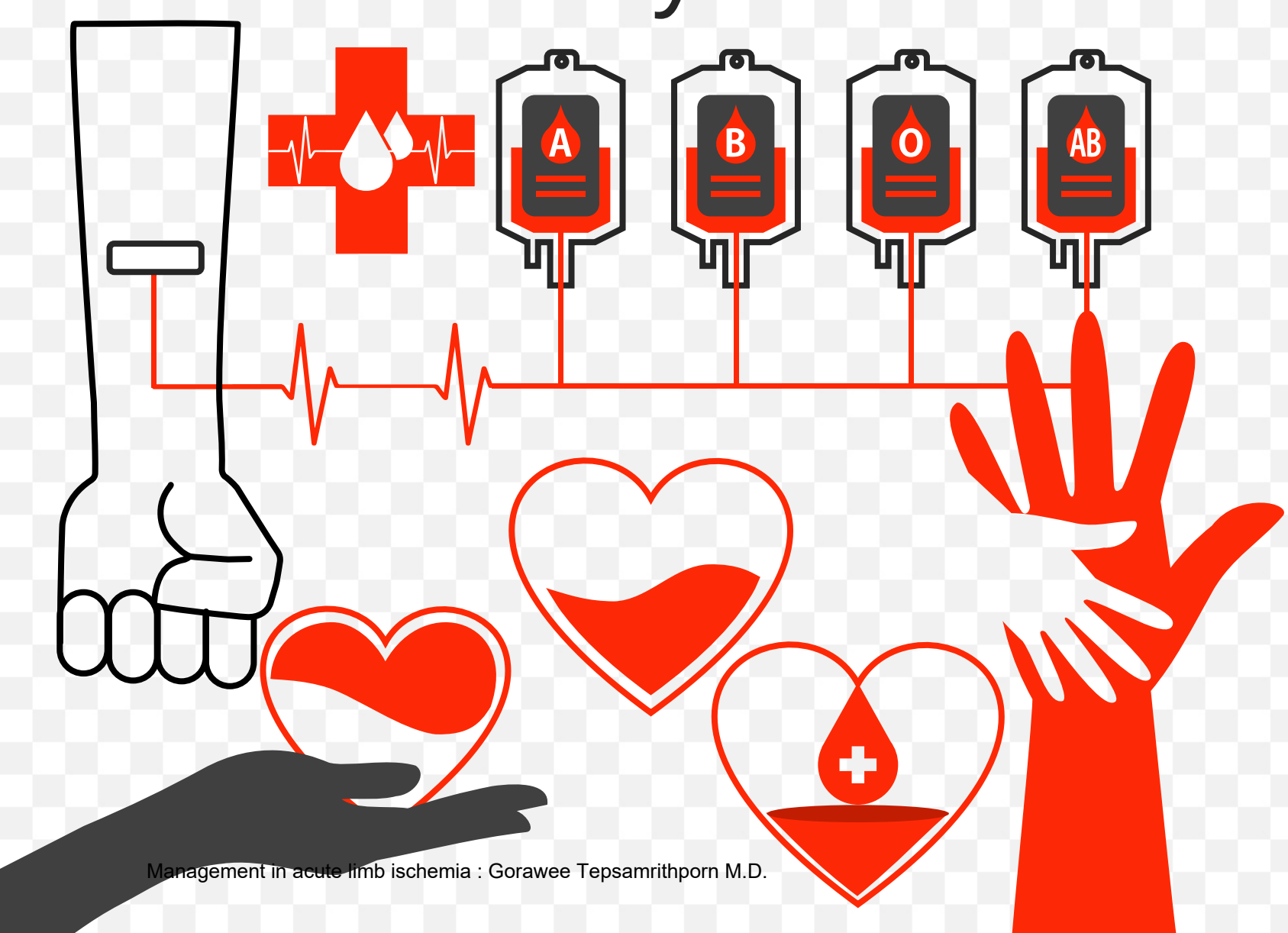
ChristopherJ.Rutherford' s vascular surgery 8th edition Vol.2, p. 2528-2543

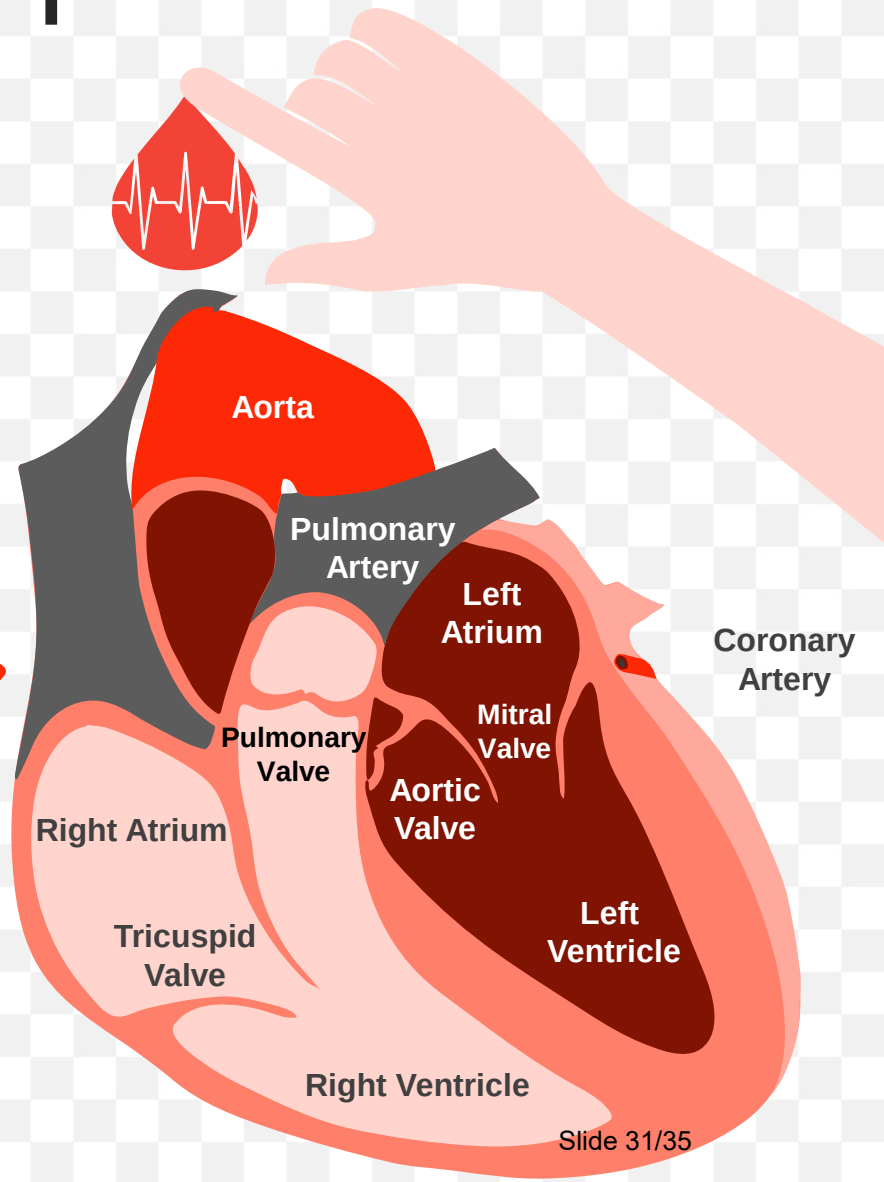
“ALI is the emergency conditions
carry the morbidity, limb loss and mortality”

Selecting the treatment
depends on the disease, patients and facilities


THANK YOU

Fully Editable Shapes





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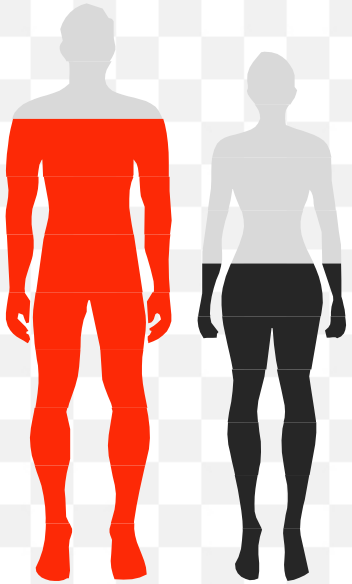

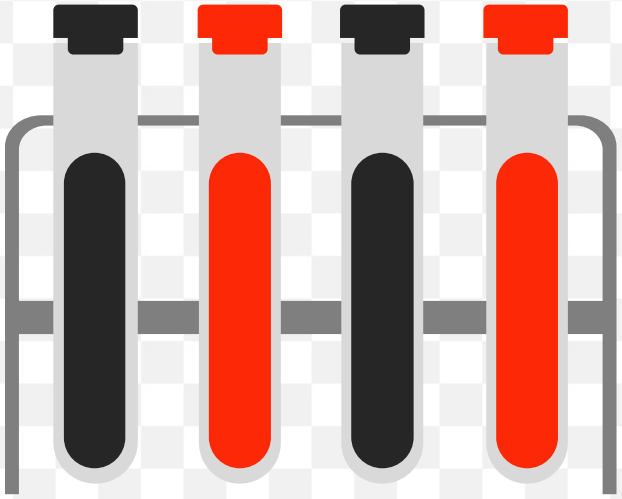

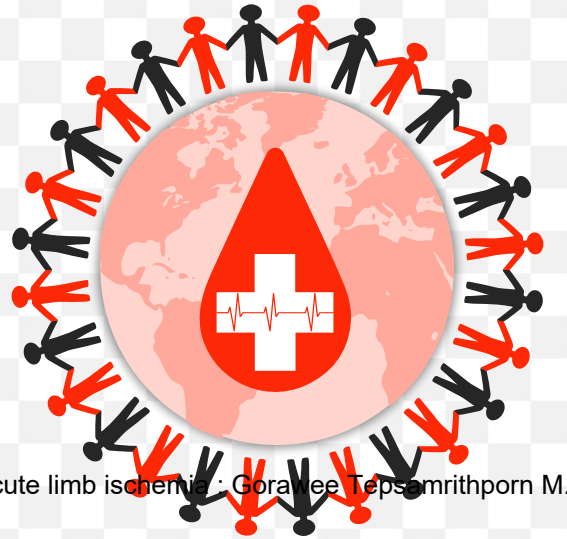

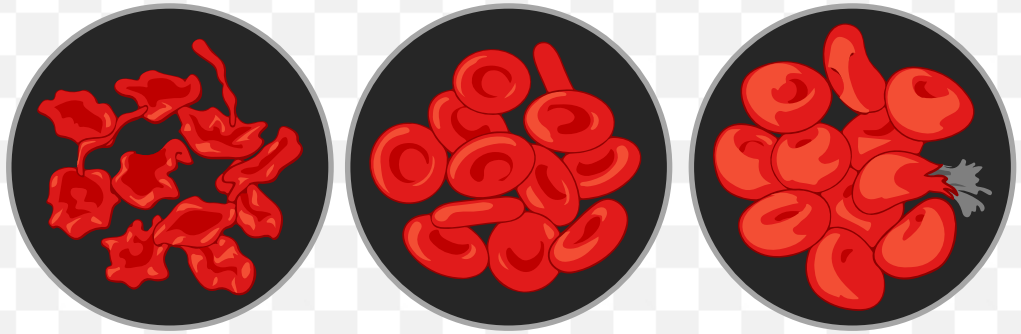

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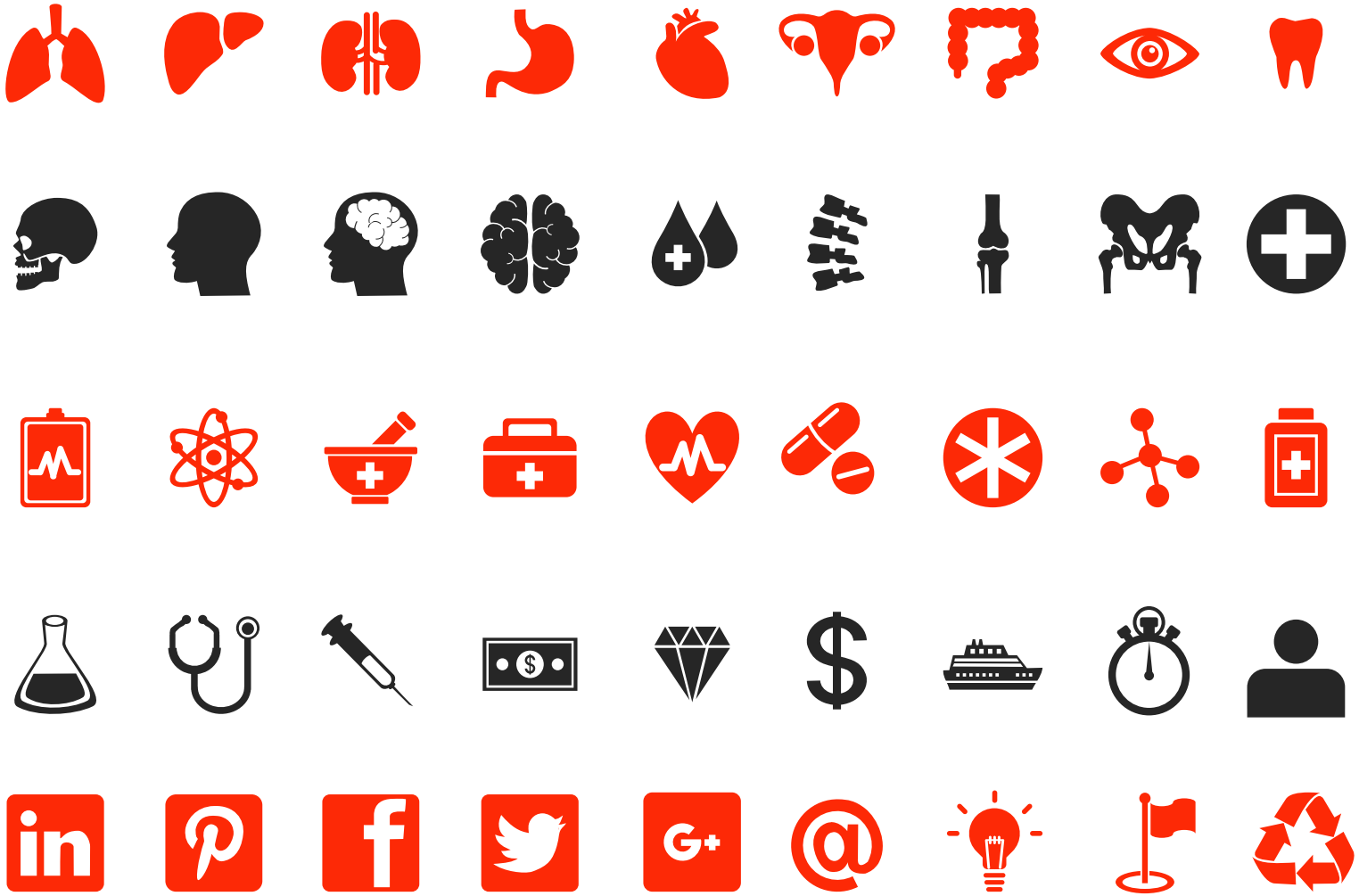

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