COVID-19 és a hemosztázis

Tánczos Krisztián, Fazakas János, Leiner Tamás, Ruszkai Zoltán, Molnár Zsolt

TM KETLAK
KORONAVÍRUS
ELLENI TRANSZLÁCIÓS
LAKOSSÁGTÁMOGATÓ
AKCIÓ- ÉS KUTATÓCSOPORT

NIHR | Applied Research Collaboration North Thames

UCLPartners

intensive care society 50 YEARS
proud to be the voice of critical care since 1970

COVID-19: shared experience among an international panel of intensive care clinicians

A rapid dissemination summary report of a facilitated 'Knowledge Sharing Session' between international clinicians from China, France, Germany, Italy, Spain, the UK and the USA with considerable collective experience of ICU management of COVID-19 infected patients. The session was hosted on 13 April 2020, 16:00 to 18:00, by the Intensive Care Society, following an informative session held previously between UK clinicians.

With thanks to our panel members

Dr Junwei Su, The First Affiliated Hospital, Zhejiang (China)

Dr Luigi Camporota, Guy's and St Thomas' Hospital NHS Foundation Trust (UK)

Dr Masoud Dara, Division of Health Emergencies & Communicable Diseases, World Health Organisation (Denmark)

Prof Maurizio Cecconi, President Elect European Society of Intensive Care Medicine (Italy)

Prof Mervyn Singer, University College London Hospital (UK)

Prof Michael Quintel, Universitätsmedizin Göttingen (Germany)

Dr Mike Grocott, University Hospitals Southampton NHS Foundation Trust (UK)

Dr Ricard Ferrer, President, Spanish Association of Critical Care (Spain)

Prof Tingbo Liang, Chairman, First Affiliated Hospital, Zhejiang (China)

Dr Tony Whitehouse, Queen Elizabeth Hospital (UK)

Dr Andre Vercueil, King's College Hospital (UK)

Dr Anthony Massaro, Brigham and Women's Hospital (USA)

Prof Antoine Viellard Baron, Hôpital Ambroise Paré (France)

Dr Bjorn Weiss, Charite Universtatsmedizin (Germany)

Dr Daniel Martin, Royal Free Hospital (UK)

Dr Dina Pfeifer, Division of Health Emergencies & Communicable Diseases, World Health Organisation (Denmark)

Dr Eduardo Mireles-Cabodevila, Cleveland Clinic (USA)

Dr Ganesh Suntharalingam, Northwick Park Hospital, Intensive Care Society (UK)

Prof Hugh Montgomery (panel chair), Whittington Hospital, Intensive Care Society (UK)

Pathophysiology: Ventilation-perfusion mismatch

This does not appear to be ARDS in initial stages but a Ventilation/Perfusion mismatch – how should this be managed?

- Several units report success in using high flow oxygen and awake proning to mitigate the need for ICU admission
- Others are using proning for CPAP patients too

Use of CPAP

Is early intubation preferable or can we defer intubation, by using non-invasive ventilation, without causing harm i.e. inducing lung injury?

No consensus but a variety of current practices described as below. No harm from use of CPAP in the following circumstances reported.

- Some use it frequently as a first-line on wards (as high as 50% of all respiratory support offered) and report much lower IPPV requirements overall
- Others focus on high flow oxygen with conscious proning (the Intensive Care Society has issued guidance on conscious proning) and then escalation to early mechanical ventilation in patients with rapidly increasing oxygen requirements
- Some units reserve CPAP for COVID-19 hypoxia where lung oedema is suggested on ultrasound imaging, CT or chest X-ray
- CPAP use is common as a ceiling of therapy
- Some units are now establishing CPAP wards as ceiling of therapy and managed by Respiratory Physicians

Mechanical Ventilation

Do we treat like a traditional ARDS picture? Do we need a high PEEP?

- **Many units agreed that initial suggestion of high PEEPs is not necessary**, although one unit was using the ARDSNET high PEEP table
  - Many units start with PEEP 10 cm H2O and reduce to PEEP 7-8 H2O
  - Use of prone positioning is common
  - A few units measure lung compliance (e.g. volume controlled ventilation 8ml/kg tidal volume) and use lower PEEP in those with low pressure (higher compliance)
- It is commonly observed that blood lactate is not elevated despite profound hypoxaemia, and bradycardia is not uncommon

What is the approach to secretion management and mucus plugging?

- There was variable experience, with some units reporting higher than expected secretions and plugging, especially after day 5/6 of intubation; others reporting no particular problems. There is variation within-country as well as internationally.
- There was no consensus on prevention or treatment strategies
  - Some units routinely practice chest physiotherapy to manage secretions
  - A few units report use of hypertonic saline, N-acetyl-cysteine and Ambroxol
  - **There was a strong consensus to use wet not dry circuits**

Mechanical Ventilation

What are observed durations of intubation, and experiences of weaning and extubation?

- Most units reported mean duration of intubation between 10 and 14 days, with one unit (which uses little CPAP and tends to intubate early) reporting mean duration as 7.5 days
- Weaning and extubation seems challenging with high re-intubation in COVID-19 patients
- Use of spontaneous breathing trials is common
  - Some combine these with additional measures to ensure patients are ready to be extubated e.g. trials of zero PEEP and /or checking that inflammatory markers are low
  - Extubation 1 to 2 days later than usual practice is common

Fluid Balance

What is the approach to fluid balance?

- Several units agreed that patients often present to ICU in a hypovolaemic state due to sweating and poor fluid intake (illness, use of CPAP) and supported the use of fluid challenges to cautiously correct this and to enhance pulmonary perfusion

Renal failure

What is the reported incidence on ITU?

- Reported incidence varies between 10-35%, without obvious signals to account for this variation
- Hypotension, hypovolaemia, high airway pressures and hypoxaemia may all contribute. Pre-existing renal disease makes renal injury more common. A role for direct disease-related injury and/ or microvascular thrombosis appears likely.
- There was general consensus that patients do not need to be run as dry as for an ARDS protocol

Patho-physiology: Pro-Coagulation

What is the approach to investigation of pro-thombotic tendency?

- High rates of thrombosis are universally seen in COVID-19. This can be induced (e.g. thrombosis around venous access) or spontaneous (usually in the venous circulation).
- There is no clear consensus on the pathogenesis of spontaneous venous clots found in the lung: they may result from emboli or from thrombosis in situ or microangiopathy. Any role of anti-platelet therapy is not known.
- There was no consensus on the prevention, detection or treatment of such events and a range of strategies are used to trigger further investigation or treatment (D-Dimer > 3,000 triggering full anticoagulation; frequent use of lower limb venous ultrasound; use of CTPA where clinical suspicion exists, or (one unit) routinely performing CTPAs with all chest CT scans. There was no clear consensus on the level that warrants treatment, nor the most effective treatment strategy.
- Some commented that Factor Xa levels needed monitoring as full heparinization was inadequate in creating sufficient anticoagulation

Infection

How do you assess for superadded infection requiring antibiotic use and have you experienced increased fungal infections in COVID-19 patients?

- There was no clear consensus on antibiotic use, although some use procalcitonin to guide their introduction
- Fungal infections (skin and systemic) seem common in some units and not others, without clear causes such as high use of steroids or antibiotics

Patho-physiology: Pro-Coagulation

What is the approach to investigation of pro-thombotic tendency?

- High rates of thrombosis are universally seen in COVID-19. This can be induced (e.g. thrombosis around venous access) or spontaneous (usually in the venous circulation).
- There is no clear consensus on the pathogenesis of spontaneous venous clots found in the lung: they may result from emboli or from thrombosis in situ or microangiopathy. Any role of anti-platelet therapy is not known.
- There was no consensus on the prevention, detection or treatment of such events and a range of strategies are used to trigger further investigation or treatment (D-Dimer > 3,000 triggering full anticoagulation; frequent use of lower limb venous ultrasound; use of CTPA where clinical suspicion exists, or (one unit) routinely performing CTPAs with all chest CT scans. There was no clear consensus on the level that warrants treatment, nor the most effective treatment strategy.
- Some commented that Factor Xa levels needed monitoring as full heparinization was inadequate in creating sufficient anticoagulation

Viscoelasztikus tesztek ?

TM TRANSLATIONAL MEDICINE

Received: 13 February 2020 | Accepted: 18 February 2020

DOI: 10.1111/jth.14768

Check for updates

jth

BRIEF REPORT

Abnormal coagulation parameters are associated with poor prognosis in patients with novel coronavirus pneumonia

Ning Tang[1] | Dengju Li[2] | Xiong Wang[1] | Ziyong Sun[1]

Received: 13 February 2020 | Accepted: 18 February 2020
DOI: 10.1111/jth.14768

BRIEF REPORT

jth

TM TRANSLATIONAL MEDICINE

Abnormal coagulation parameters are associated with poor prognosis in patients with novel coronavirus pneumonia

Ning Tang[1] | Dengju Li[2] | Xiong Wang[1] | Ziyong Sun[1]

TABLE 1 Coagulation parameters of NCP patients on admission

Parameters	Normal range	Total (n = 183)	Survivors (n = 162)	Non-survivors (n = 21)	*P* values
Age (years)		54.1 ± 16.2	52.4 ± 15.6	64.0 ± 20.7	<.001
Sex (male/female)		98/85	82/80	16/5	.035
With underlying diseases		75 (41.0%)	63 (38.9%)	12 (57.1%)	.156
On admission					
PT (sec)	11.5-14.5	13.7 (13.1-14.6)	13.6 (13.0-14.3)	15.5 (14.4-16.3)	<.001
APTT (sec)	29.0-42.0	41.6 (36.9-44.5)	41.2 (36.9-44.0)	44.8 (40.2-51.0)	.096
Fibrinogen (g/L)	2.0-4.0	4.55 (3.66-5.17)	4.51 (3.65-5.09)	5.16 (3.74-5.69)	.149
D-dimer (μg/mL)	<0.50	0.66 (0.38-1.50)	0.61 (0.35-1.29)	2.12 (0.77-5.27)	<.001
FDP (μg/mL)	<5.0	4.0 (4.0-4.9)	4.0 (4.0-4.3)	7.6 (4.0-23.4)	<.001
AT (%)	80-120	91 (83-97)	91 (84-97)	84 (78-90)	.096

Abbreviations: APTT, activated partial thromboplastin time; AT, antithrombin activity; FDP, fibrin degradation product; NCP, novel coronavirus pneumonia; PT, prothrombin time (PT).

Received: 13 February 2020 | Accepted: 18 February 2020
DOI: 10.1111/jth.14768

BRIEF REPORT

Abnormal coagulation parameters are associated with poor prognosis in patients with novel coronavirus pneumonia

Ning Tang[1] | Dengju Li[2] | Xiong Wang[1] | Ziyong Sun[1]

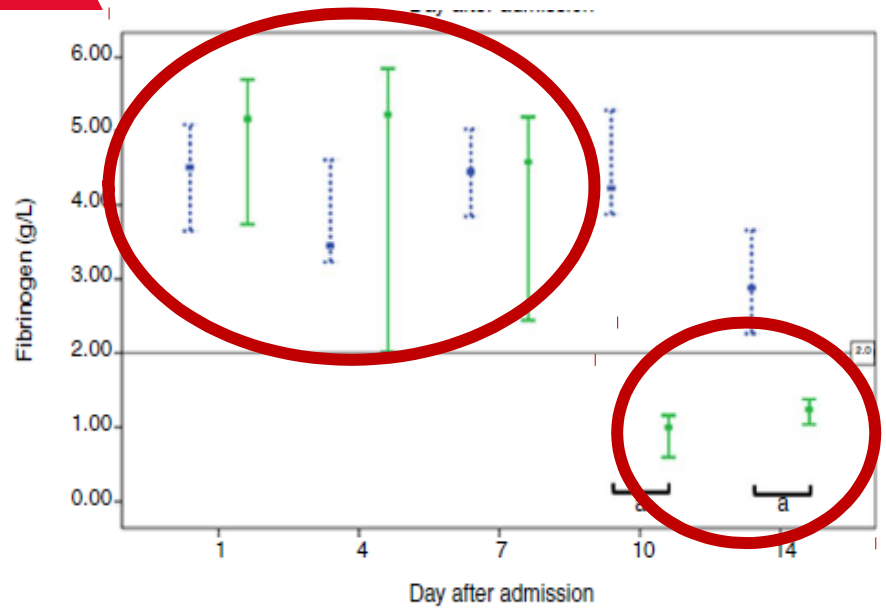
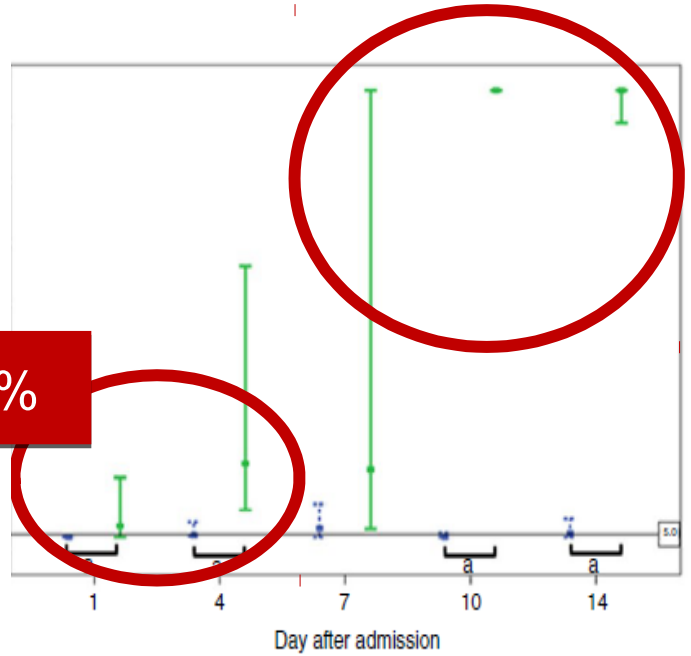


TABLE 2 The grade o DIC in non-survivors with NCP (n = 21)

	Number of patients (%)
Platelet counts (×10⁹/L)	
50-100 (1 point)	7 (33.3)
<50 (2 points)	5 (23.8)
D-dimer (μg/mL)	
1.0-3.0 (2 points)	3 (14.3)
>3.0 (3 points)	
Fibrinogen (g/L)	
<1.0 (1 point)	6 (28.6)
Prolongation of PT (sec)	
3-6 (1 point)	5 (23.8)
>6 (2 points)	10 (47.6)
Meeting the ISTH criteria of DIC (Total points ≥5)	15 (71.4)

Survivors: 0.6%



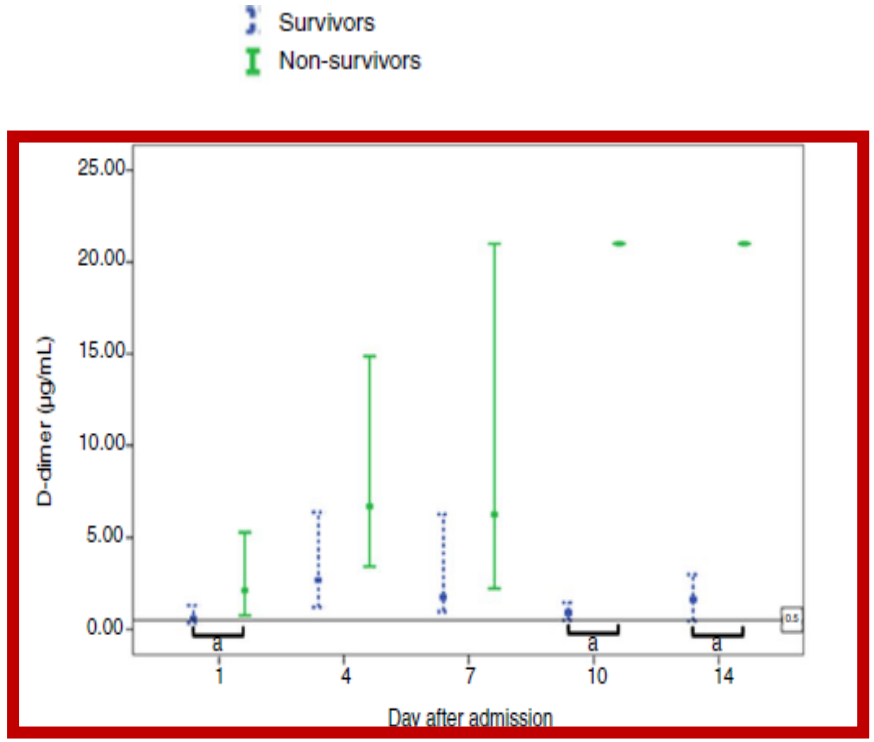
Hyperkoaguláció + Fibrinolízis → DIC

Received: 13 February 2020 | Accepted: 18 February 2020
DOI: 10.1111/jth.14768

BRIEF REPORT

Abnormal coagulation parameters are associated with poor prognosis in patients with novel coronavirus pneumonia

Ning Tang[1] | Dengju Li[2] | Xiong Wang[1] | Ziyong Sun[1]



Hyperkoaguláció + Fibrinolízis → DIC

Table 1 D-dimer levels and their association with disease severity and prognosis in COVID-19

Study	Baseline D-dimer and COVID-19 disease severity	Baseline D-dimer and prognosis	D-dimer during follow-up
Chen et al (7) Single-center retrospective cohort	Severe (N=11): median 2,600 µg/L Moderate: (N=10) median 300 µg/L P=0.029		
Guan et al (8)	Severe (N=109): >500 µg/L in 60%	ICU, MV, or death (N=49): >500 µg/L in 69%	
Zhou et al (9)		Non-survivors (N=54): >500-1000 µg/L in 11% and >1000 µg/L in 81%	Non-survivors: D-dimer increase up to 42,200 at day 22
Li et al (12) Single-center retrospective cohort			Non-survivors (N=12): D-dimer levels increased in 75% of patients during follow-up from a median of 1,180 µg/L to 9,930 µg/L

Report on Diagnosis, Prevention and Treatment of Thromboembolic Complications in COVID-19 for the National Institute for Public Health of the Netherlands

April 9 2020

Prof dr Matthijs Oudkerk (University of Groningen) - Chair
Prof dr Harry Büller (University of Amsterdam)
Prof dr Edwin van Beek (University of Edinburgh)
Prof dr Hugo ten Cate (Universiteit van Maastricht)
Dr Dirkjan Kuijpers (Haaglanden Medisch Centrum)
Dr Nick van Es (Amsterdam Medical Center)
Dr Sytse Oudkerk (Netherlands Cancer Institute - Antoni van Leeuwenhoek Ziekenhuis)
Prof dr Theresa McLoud (Massachusetts General Hospital, Harvard University)

a) Betegség progressziója:

légzési elégtelenség ➡ ARDS

hypoinflammáció, „cytokin release” sy

hyperkoaguláció ➡ DIC

b) Várhatóan Súlyos vs nem súlyos betegek

ITO felvétel, gépi lélegeztetés, high vs low PEEP,

antivirális terápia

c) Thromboembólia szövődmények felismerése

(DVT, PE vagy pulmonary venous thrombosis (PVT).

Thromboembóliás komplikációk és COVID-19

Thrombosis Research https://doi.org/10.1016/j.thromres.2020.04.013

Incidence of thrombotic complications in critically ill ICU patients with COVID-19

F.A. Klok[a,*], M.J.H.A. Kruip[b], N.J.M. van der Meer[c], M.S. Arbous[d], D.A.M.P.J. Gommers[e], K.M. Kant[f], F.H.J. Kaptein[a], J. van Paassen[d], M.A.M. Stals[a], M.V. Huisman[a,1], H. Endeman[e,1]

…The cumulative incidence of the **composite outcome was 31%** (95% CI 20-41%), of which CTPA and/or ultrasonography confirmed **VTE in 27%** (95%CI 17-37%) and **arterial thrombotic events in 3.7%** (95% CI 0-8.2%)….

Thromboembóliás szövődmények az ITO-n

The NEW ENGLAND JOURNAL of MEDICINE
N Engl J Med 2011;364:1305-14.

ORIGINAL ARTICLE

Dalteparin versus Unfractionated Heparin in Critically Ill Patients

The PROTECT Investigators for the Canadian Critical Care Trials Group and the Australian and New Zealand Intensive Care Society Clinical Trials Group

Table 3. Venous Thromboembolic Outcomes.

Outcome	Intention-to-Treat Analysis				As-Treated Analysis			
	Dalteparin (N=1873)	Unfractionated Heparin (N=1873)	Hazard Ratio (95% CI)	P Value	Dalteparin (N=1827)	Unfractionated Heparin (N=1832)	Hazard Ratio (95% CI)	P Value
	no. (%)				*no. (%)*			
Deep-vein thrombosis								
Proximal	96 (5.1)	109 (5.8)	0.92 (0.68–1.23)	0.57	94 (5.1)	108 (5.9)	0.91 (0.68–1.23)	0.54
Any	138 (7.4)	161 (8.6)	0.93 (0.72–1.19)	0.54	135 (7.4)	160 (8.7)	0.92 (0.72–1.19)	0.54
Pulmonary embolism								
Any	24 (1.3)	43 (2.3)	0.51 (0.30–0.88)	0.01	22 (1.2)	42 (2.3)	0.48 (0.27–0.84)	0.01
Possible	1 (<0.1)	4 (0.2)			1 (<0.1)	4 (0.2)		
Probable	5 (0.3)	11 (0.6)			4 (0.2)	10 (0.5)		
Definite	18 (1.0)	28 (1.5)			17 (0.9)	28 (1.5)		
Definite or probable	23 (1.2)	39 (2.1)	0.53 (0.30–0.92)	0.02	21 (1.1)	38 (2.1)	0.49 (0.28–0.88)	0.02
Any venous thromboembolism	154 (8.2)	186 (9.9)	0.87 (0.69–1.10)	0.24	150 (8.2)	184 (10.0)	0.87 (0.69–1.10)	0.24
Venous thromboembolism or death	530 (28.3)	589 (31.4)	0.89 (0.79–1.01)	0.07	511 (28.0)	575 (31.4)	0.89 (0.78–1.004)	0.06

TABLE 2. Independent Risk factors for Thromboprophylaxis Failure: Venous Thromboembolism and Proximal Leg Deep Vein Thrombosis Acquired During Critical Illness

Possible Risk Factors	VTE Hazard Ratio (95% CI)	*p*	Proximal Leg Deep Vein Thrombosis Hazard Ratio (95% CI)	*p*
Baseline factors				
Low-molecular-weight heparin vs	0.85 (0.67–1.08)	0.19	0.88 (0.65–1.19)	0.40

TABLE 3. Independent Risk Factors for Thromboprophylaxis Failure: Pulmonary Embolism Acquired During Critical Illness

Possible Risk Factors	Pulmonary Embolism Hazard Ratio (95% CI)	*p*
Baseline factors		
Low-molecular-weight heparin vs unfractionated heparin as randomized	0.51 (0.27–0.95)	0.034
Acute Physiology and Chronic Health Evaluation II (10-point increase)	0.78 (0.52–1.16)	0.214
Personal/family history of venous thromboembolism	1.36 (0.42–4.40)	0.607
Body mass index (10-point increase)	1.37 (1.02–1.83)	0.035
Time-dependent factors		
Vasopressors or inotropes	1.84 (1.01–3.35)	0.046
Central venous catheter	1.36 (0.86–2.15)	0.18
RBC transfusion	0.95 (0.70–1.30)	0.77
Platelet transfusion	1.44 (0.58–3.57)	0.43
Acetylsalicylic acid or thienopyridine	1.10 (0.82–1.46)	0.53
Erythropoietin-stimulating agents	0.54 (0.19–1.57)	0.26
Statin	0.76 (0.52–1.09)	0.14

Thromboembóliás komplikációk és COVID-19

Thrombosis Research https://doi.org/10.1016/j.thromres.2020.04.013

Incidence of thrombotic complications in critically ill ICU patients with COVID-19

F.A. Klok[a,*], M.J.H.A. Kruip[b], N.J.M. van der Meer[c], M.S. Arbous[d], D.A.M.P.J. Gommers[e], K.M. Kant[f], F.H.J. Kaptein[a], J. van Paassen[d], M.A.M. Stals[a], M.V. Huisman[a,1], H. Endeman[e,1]

…The cumulative incidenc … % CI 20-41%), of which CTPA and/or ultra … 7-37%) and **arter** …%)….

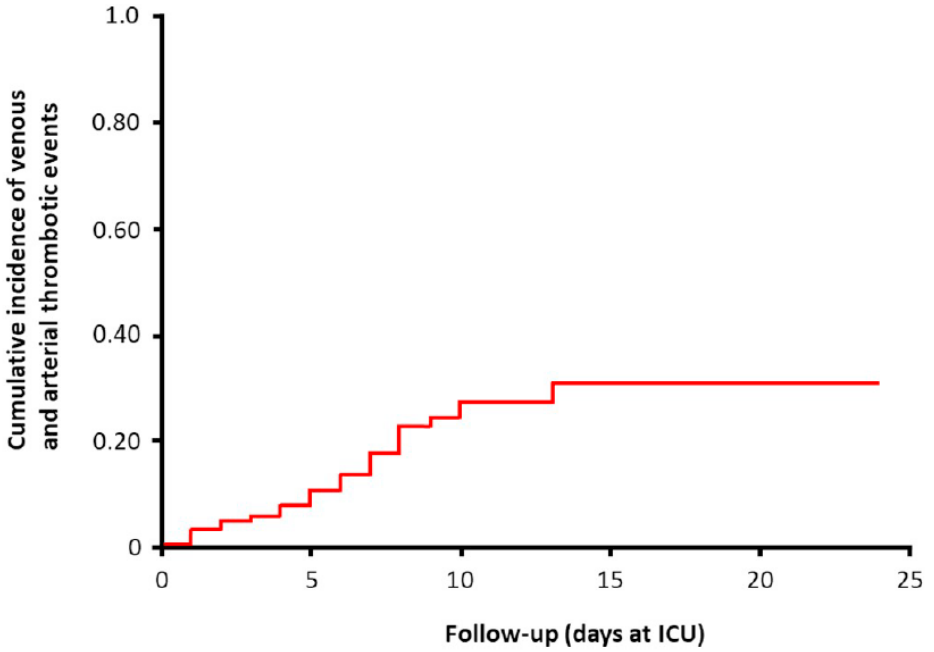


Fig. 1. Cumulative incidence of venous and arterial thrombotic complications during the course of intensive care unit admission of patients with proven COVID-19 pneumonia.

Table 3
Description of thrombotic complications.

Type of event	
Pulmonary embolism	…teries, 7 cases PE limited to subsegmental arteries
Other venous thromboembolic events	…eg
	…bosis
Arterial thrombotic events	

Note: acute pulmonary embolism was diagnos… …xtremity vein thrombosis was diagnosed with ultrasonography, strokes were diagnosed with …

journal of thrombosis and haemostasis™

TM TRANSLATIONAL MEDICINE

BRIEF REPORT | Free Access

Prevalence of venous thromboembolism in patients with severe novel coronavirus pneumonia

Songping Cui, Shuo Chen, Xiunan Li, Shi Liu, Feng Wang

First published:09 April 2020 | https://doi.org/10.1111/jth.14830

Cut-off (μg/mL)	Sensitivity (%)	Specificity (%)	PPV (%)	NPV (%)
1.0	85.0	77.0	54.8	94.0
1.5	85.0	88.5	70.8	94.7
2.0	80.0	90.2	72.7	93.2
2.5	70.0	93.4	77.8	90.5
3.0	70.0	96.7	87.5	90.8
3.5	65.0	96.7	86.7	89.4

D-dimer (μg/mL)	0.0-0.5	5.2±3.0	0.8±1.2	<0.001

Terápiás lehetőségek?

Standard profilaxis Inj Nandroparine 2x4000 IU

Koagulációs tesztek

Protokol módosítás: LMWH 2x 6000 IU (8000 IU body mass index > 35);
Antithrombin koncentrátum, ha a kezdeti < 70%;
Clopidogrel: 300 mg + 75 mg/day, ha tct > 400,000 sejt/μL.

Objectives. Prospective observational study aimed to characterize the coagulation profile of COVID-19 ARDS patients with standard and viscoelastic coagulation tests, and to evaluate their changes after establishment of an aggressive thromboprophylaxis.

Standard tests	Normal range	Baseline
Platelet count (x1,000 cells/μL)	150 - 450	271 (192-302)
Antithrombin (%)	80 - 120	85 (65-91)
D-dimer (μg/mL)	< 0.5	3.5 (2.5-6.5)
Interleukin-6 (pg/mL)	0 - 10	218 (116-300)

Thromboembóliás komplikációk és COVID-19

Thrombosis Research https://doi.org/10.1016/j.thromres.2020.04.013

Incidence of thrombotic complications in critically ill ICU patients with COVID-19

F.A. Klok[a,*], M.J.H.A. Kruip[b], N.J.M. van der Meer[c], M.S. Arbous[d], D.A.M.P.J. Gommers[e], K.M. Kant[f], F.H.J. Kaptein[a], J. van Paassen[d], M.A.M. Stals[a], M.V. Huisman[a,1], H. Endeman[e,1]

Table 2
Local protocol for thromboprophylaxis in participating centres for patients admitted to the intensive care unit during the study period.

Site	
Leiden University Medical Center	nadroparin 2850 IU sc per day or 5700 IU per day if body weight > 100 kg
Erasmus University Medical Center	Nadroparin 5700 IU per day; nadroparin 5700 IU sc twice daily from April 4th 2020 and onwards
Amphia Hospital Breda	Nadroparin 2850 IU sc per day or 5700 IU per day if body weight > 100 kg; nadroparin 5700 IU sc per day from March 30th 2020 and onwards

jth journal of thrombosis and haemostasis™

patients received heparin treatment for at least 7 days, in

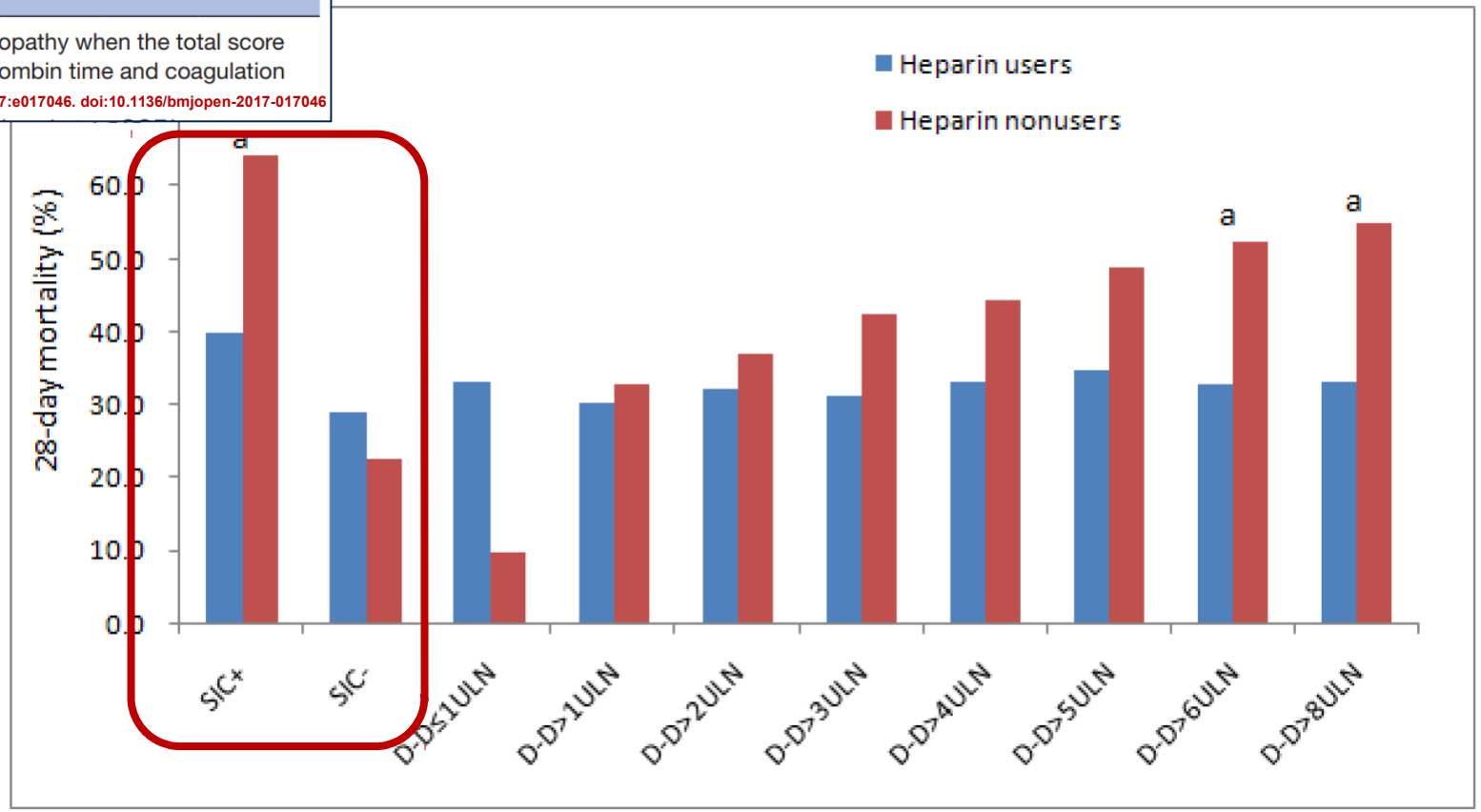
received **LMWH (40-60 mg enoxaparin/day**)

d 5 received **UFH (10000-15000 U/day),**

Table 3 Scoring for the diagnosis of sepsis-induced coagulopathy

Category	Parameter	0 point	1 point	2 points
Prothrombin time	PT-INR	≦1.2	>1.2	>1.4
Coagulation	Platelet count ($\times 10^9$/L)	≧150	<150	<100
Total SOFA	SOFA four items	0	1	≧2

Diagnosed as sepsis-induced coagulopathy when the total score is 4 or more with total score of prothrombin time and coagulation exceeding 2. Iba T, et al. BMJ Open 2017;7:e017046. doi:10.1136/bmjopen-2017-017046



Attention should be paid to venous thromboembolism prophylaxis in the management of COVID-19

Lancet Haematol 2020
Published Online
April 9, 2020
https://doi.org/10.1016/
S2352-3026(20)30109-5

- **Management recommendations**: pat … can rapidly develop physiological changes which mean their need for prophylaxi … g VTE and bleeding risks regularly is essential.

Table 3—*Independent Risk Factors for Bleeding in 10,866 Hospitalized Medical Patient*[10]

Risk Factor[a]	Total Patients, No. (%) (N = 10,866)	OR (95% CI)
Active gastroduodenal ulcer	236 (2.2)	4.15 (2.21-7.77)
Bleeding in 3 mo before admission	(2.2)	3.64 (2.21-5.99)
Severe renal failure (GFR < 30 mL/min/m²)	(11.0)	2.14 (1.44-3.20)
ICU or CCU admission	(8.5)	2.10 (1.42-3.10)
Central venous catheter	(7.5)	1.85 (1.18-2.90)
Rheumatic disease	(6.8)	1.78 (1.09-2.89)
Current cancer	(10.7)	1.78 (1.20-2.63)
Male sex	(49.4)	1.48 (1.10-1.99)

Items	Score
Obesity (BMI ≥3	1
Ongoing hormonal treatment	1

High risk of VTE: ≥4 points. VTE: Venous thromboembolism; BMI: Body mass index.

patients.

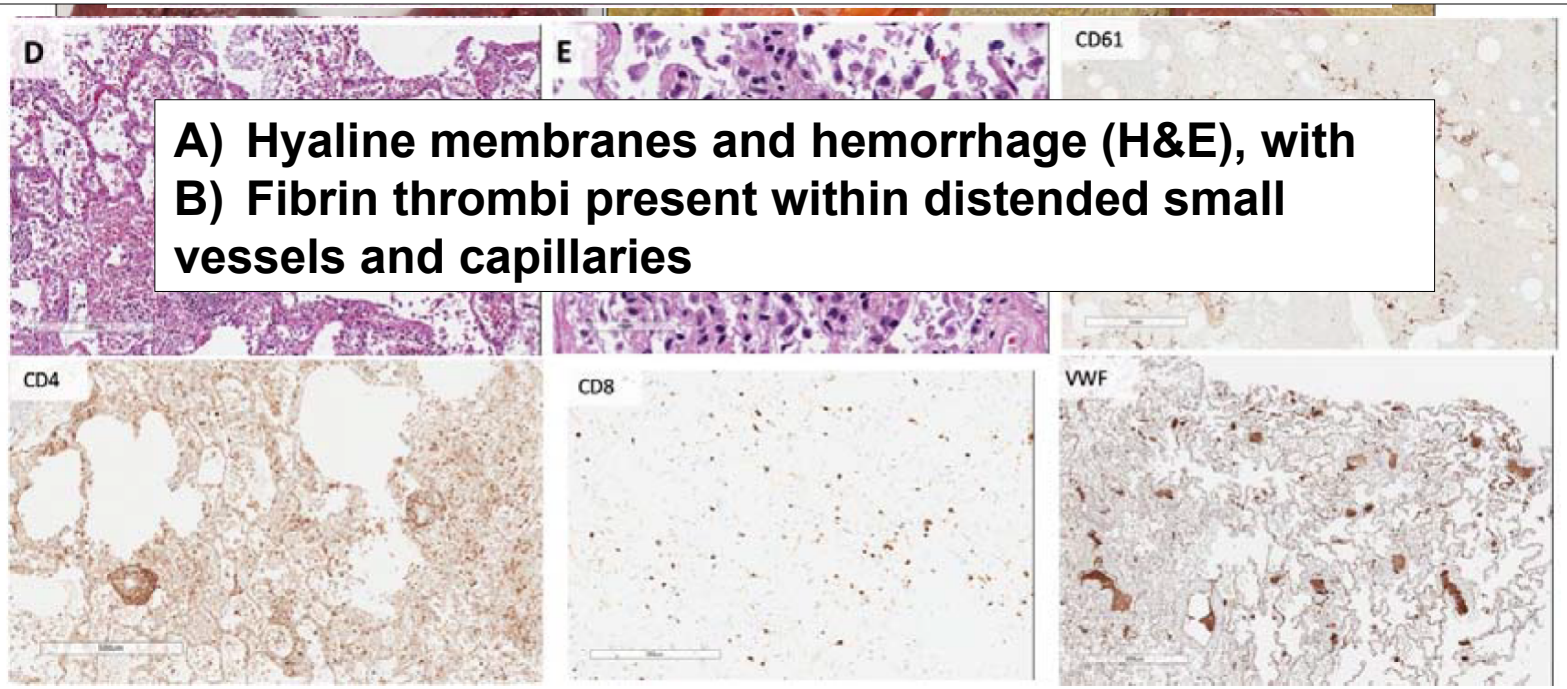
Table: Bleedi … of venous thromboemb

medRxiv
THE PREPRINT SERVER FOR HEALTH SCIENCES
CSH Cold Spring Harbor Laboratory BMJ Yale
Posted April 10, 2020.

Pulmonary and Cardiac Pathology in Covid-19:The First Autopsy Series from New Orleans

TM TRANSLATIONAL MEDICINE

D) Perivascular aggregations of lymphocytes, which were positive for CD4 immunostain, with only scattered CD8 positive cells present.
E) Numerous megakaryocytes were present within the small vessels and alveolar capillaries, highlighted by CD61 and Von Willebrand Factor immunostains.



A) Hyaline membranes and hemorrhage (H&E), with
B) Fibrin thrombi present within distended small vessels and capillaries

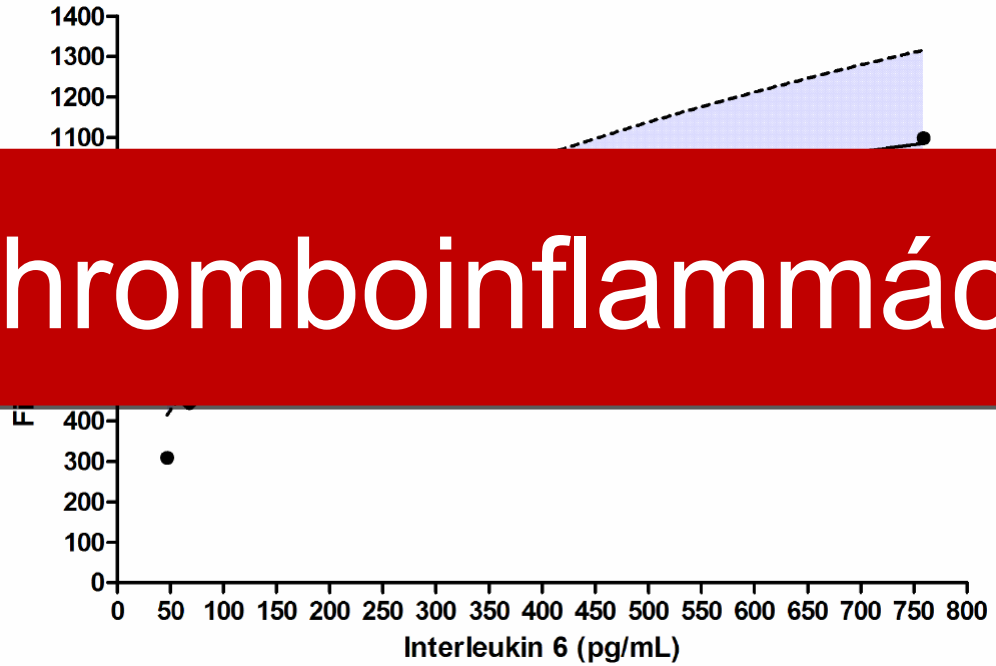
journal of thrombosis and haemostasis™

TM TRANSLATIONAL MEDICINE

BRIEF REPORT | Free Access

The procoagulant pattern of patients with COVID-19 acute respiratory distress syndrome

Marco Ranucci, Andrea Ballotta, Umberto Di Dedda, Ekaterina Bayshnikova, Marco Dei Poli, Marco Resta, Mara Falco, Gianni Albano, Lorenzo Menicanti



Thromboinflammáció

TM TRANSLATIONAL MEDICINE

Song *et al. Military Medical Research* (2020) 7:19
https://doi.org/10.1186/s40779-020-00247-7

MMR MILITARY MEDICAL RESEARCH

POSITION ARTICLE AND GUIDELINES Open Access

Chinese expert consensus on diagnosis and treatment of coagulation dysfunction in COVID-19

Jing-Chun Song[1*], Gang Wang[2], Wei Zhang[3], Yang Zhang[4], Wei-Qin Li[5*], Zhou Zhou[4*] , People's Liberation Army Professional Committee of Critical Care Medicine, Chinese Society on Thrombosis and Haemostasis

Emerging questions for consideration

- *What is the pathophysiology of coagulopathy in COVID-19, and when in the course of the disease does it occur? How should it be diagnosed and managed?*
- *Why do some centers see problematic plugging and others not?*
- *Why is there a variation in rates of kidney injury?*