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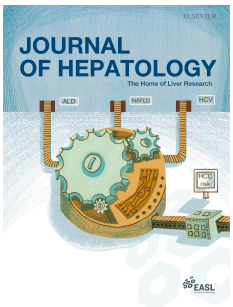

High Mortality Rates for SARS-CoV-2 Infection in Patients with Pre-existing Chronic Liver Disease and Cirrhosis: Preliminary Results from an International Registry

Andrew M. Moon, MD MPH, Gwilym J. Webb, PhD MRCP, Costica Aloman, MD, Matthew J. Armstrong, PhD MRCP, Tamsin Cargill, PGDip MRCP, Renumathy Dhanasekaran, MD, Joan Genescà, MD, Upkar S. Gill, PhD MRCP, Theodore W. James, MD, MSCR, Patricia D. Jones, MD, MSCR, Aileen Marshall, PhD MRCP, George Mells, PhD MRCP, Ponni V. Perumalswami, MD, MSCR, Xiaolong Qi, MD, Feng Su, MD, MSCR, Nneka N. Ufere, MD, Eleanor Barnes, DPhil MRCP, A Sidney Barritt, IV, MD MSCR, Thomas Marjot, BSc MRCP

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Title: High Mortality Rates for SARS-CoV-2 Infection in Patients with Pre-existing Chronic Liver Disease and Cirrhosis: Preliminary Results from an International Registry.

Authors: Andrew M Moon MD MPH* (1), Gwilym J Webb PhD MRCP* (2), Costica Aloman MD (3), Matthew J Armstrong PhD MRCP (4), Tamsin Cargill PGDip MRCP (2), Renumathy Dhanasekaran MD (5), Joan Genescà MD (6), Upkar S Gill PhD MRCP (7), Theodore W James MD, MSCR (1), Patricia D Jones MD, MSCR(8), Aileen Marshall PhD MRCP (9), George Mells PhD MRCP (10), Ponni V Perumalswami MD, MSCR (11), Xiaolong Qi MD (12), Feng Su MD, MSCR (13), Nneka N Ufere MD (14), Eleanor Barnes DPhil MRCP* (2), A Sidney Barritt IV MD MSCR* (1), Thomas Marjot BSc MRCP* (2).

Affiliations:

(1) Division of Gastroenterology and Hepatology, University of North Carolina, Chapel Hill, NC, USA.

(2) Oxford Liver Unit, Translational Gastroenterology Unit, John Radcliffe Hospital, Oxford University Hospitals, Oxford, UK

(3) Department of Medicine, Section of Hepatology, Rush University Medical Center, Chicago, Illinois, USA

(4) Liver Unit, Queen Elizabeth Hospital Birmingham, Birmingham, UK

(5) Department of Medicine, Stanford University School of Medicine, Palo Alto, CA, USA

(6) Liver Unit, Hospital Universitari Vall d'Hebron, Vall d'Hebron Research Institute (VHIR), Universitat Autònoma de Barcelona and Centro de Investigación Biomédica en Red de Enfermedades Hepáticas y Digestivas (CIBERehd), Instituto de Salud Carlos III, Spain.

(7) Barts Liver Centre, Barts Health NHS Trust & Barts & The London School of Medicine & Dentistry, Queen Mary University of London, UK

(8) Division of Digestive Health and Liver Diseases, Department of Medicine, University of Miami Miller School of Medicine, Miami, FL, USA

(9) Sheila Sherlock Liver Unit, Royal Free Hospital, London, UK

(10) Cambridge Liver Unit, Addenbrooke's Hospital, Cambridge University Hospitals, Cambridge, UK

(11) Division of Liver Diseases, Department of Medicine, Icahn School of Medicine at Mount Sinai, New York, NY, USA

(12) CHESS Center, Institute of Portal Hypertension, The First Hospital of Lanzhou University, Lanzhou, China

(13) Division of Gastroenterology, University of Washington, Seattle, WA, USA

(14) Liver Center and Gastrointestinal Division, Massachusetts General Hospital, Harvard Medical School, Boston, Massachusetts, USA

Corresponding Author:

Dr Thomas Marjot

Oxford Liver Unit, Translational Gastroenterology Unit, Oxford University Hospitals NHS Trust, OX3 9DU

Thomas.marjot@ndm.ox.ac.uk

Author contributions:

Concept and Design: TM, AMM, EB, ASB, GW, TWJ

Acquistion of data: CA, MJA, TC, RD, JG, USG, TWJ, PDJ, AM, GM, PVP, XQ, FS, NNU

Statistical analysis: TM, AMM, GW

Interpretation of data: TM, AMM, EB, ASB, GW

Drafting and critical revision of manuscript: TM, AMM, EB, ASB, GW

* These authors contributed equally.

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Tables 1

Figures 1

Abbreviations:

CLD – chronic liver disease

COVID-19 – coronavirus disease 2019

CTP – Child-Turcotte-Pugh

MELD – Model for end-stage liver disease

SARS-CoV-2 – Severe acute respiratory syndrome coronavirus 2

To the Editor: Chronic liver disease (CLD) and cirrhosis are common conditions[1] associated with immune dysregulation[2] leading to concerns that these patients are at increased risk for complications of severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) and resulting coronavirus disease 2019 (COVID-19).[3] However, the effects of COVID-19 among patients with pre-existing liver disease are currently undefined.

We report the outcomes of the first 152 consecutive submissions of clinician-reported cases of laboratory-confirmed COVID-19 in patients with CLD to two international reporting registries (COVID-Hep.net and COVIDCirrhosis.org) between 25 March 2020 and 20 April 2020. Our combined database includes 103 patients with cirrhosis and 49 with non-cirrhotic CLD from 21 countries across 4 continents (59.9% male, median age 61 years, aetiology 22.4% non-alcoholic fatty liver disease, 19.7% alcohol, 11.8% hepatitis B, 10.5% hepatitis C, 35.6% other/combination).

Contributors were encouraged to enter data at the end of the patient's disease course. For patients admitted to hospital, cases were only included in the analysis if a definitive outcome of death or discharge was reported. 95.2% of patients with cirrhosis were hospitalised with a median length of hospital stay until discharge or death of 10 days (IQR 5-14 days). Outcomes for patients with cirrhosis included admission to intensive care unit (ICU) in 23.3%, invasive ventilation in 17.5%, non-invasive ventilatory support in 18.6%, renal replacement therapy 4.9% and death in 39.8%. Mortality far exceeded that reported in unselected populations[4], hospitalised patients with cirrhosis in the era preceding COVID-19[5], and in patients with cirrhosis admitted with influenza.[6] In patients not admitted to ICU, 59.5 % had non-severe disease, 27.8% had severe disease but escalation of care was deemed inappropriate, and 3.7% were considered to require ICU but were not admitted due to lack of availability. Targeted antiviral therapy was used in 38.1% of total

cases. The most frequently used treatments were chloroquine/hydroxychloroquine (23.0%), lopinovir/ritonavir (6.6%), tocilizumab (3.3%), and interferon-alpha (3.3%).

Cause of death in patients with cirrhosis was reported as COVID-19 lung disease in 78.7%, cardiac-related in 4.3%, and liver-related in 12.2%. Risk factors for poor COVID-19 outcomes in the general population including advanced age, obesity, renal impairment, heart disease, and diabetes mellitus were over-represented among those who died, although male sex and non-white ethnicity were not.[7] Mortality correlated strongly with baseline Child-Turcotte-Pugh (CTP) class and model for end-stage liver disease (MELD) score **(Table 1)**. Deaths occurred in 12.2% of CLD without cirrhosis, 23.9% CTP-A cirrhosis, 43.3% CTP-B cirrhosis, and 63.0% CTP-C cirrhosis **(Fig. 1A)**. CTP-B and CTP-C cirrhosis remained associated with death after adjusting for baseline characteristics including comorbidities **(Table 1)**. CTP-B and CTP-C cirrhosis remained significant predictors of mortality even when analysis was restricted to those with cirrhosis.

Hepatic decompensation occurred in 36.9% and was associated with baseline CTP class **(Fig. 1B).** Decompensation events included worsening ascites (27.2%), spontaneous bacterial peritonitis (2.9%), hepatic encephalopathy (16.5%), and variceal haemorrhage (1%). Hepatic decompensation during COVID-19 was strongly associated with a subsequent risk of death: 63.2% of those with new decompensation died compared to 26.2% of those without new decompensation. Notably, 24.3% of those with new hepatic decompensation had no respiratory symptoms of COVID-19 at the time of diagnosis.

This large, multicentre, international cohort of patients with chronic liver disease and cirrhosis allows for in depth assessment of the clinical factors associated with poor outcomes from COVID-19. Accepting that data from registries are subject to selection bias, preliminary findings suggest that baseline liver disease severity is strongly associated with COVID-19-related morbidity and mortality. Furthermore, many SARS-CoV-2-infected patients with cirrhosis experienced hepatic

decompensation even in the absence of respiratory symptoms. These findings have important implications for clinicians regarding risk stratification and prognostication for patients with cirrhosis and COVID-19 and suggest the need to maintain a low threshold for SARS-CoV-2 testing in the presence of new hepatic decompensation.

	Total; n = 152		Survived; n = 105		Died; n = 47		Univariable analysis	Multivariable analysis	
Variable	**Median or n**	**IQR or %**	**Median or n**	**IQR or %**	**Median or n**	**IQR or %**	**p value†**	**OR (95%CI) for death**	**p value§**
Age (years)	61	48-71	60	46-70	64	57-73	**0.025**	1.04 (1.00-1.09)	**0.048**
Sex (male)	91	59.9%	61	58.1%	30	63.8%	0.666	-	-
White ethnicity	86	56.6%	56	53.3%	30	63.8%	0.228	-	-
Smoker	9	5.9%	7	6.7%	2	4.3%	0.560	-	-
Obese (BMI >30 kg/m2)	33	21.7%	18	17.1%	15	31.9%	**0.017**	3.59 (1.10-10.47)	**0.033**
Cardiovascular disease	33	21.7%	18	17.1%	15	31.9%	**0.041**	1.87 (0.57-6.15)	0.303
Diabetes mellitus	54	35.5%	30	28.6%	24	51.1%	**0.007**	2.86 (1.00-8.20)	0.051
Hypertension	60	39.5%	35	33.3%	25	53.2%	**0.021**	0.71 (0.22-2.24)	0.555
Liver disease severity									
CLD without cirrhosis	49	32.2%	43	41.0%	6	12.8%	**<0.001**	1.00	-
CTP A cirrhosis	46	30.3%	35	33.3%	11	23.4%		1.21 (0.30-4.90)	0.789
CTP B cirrhosis	30	19.7%	17	16.2%	13	27.7%		4.90 (1.16-20.61)	**0.030**
CTP C cirrhosis	27	17.8%	10	9.5%	17	36.2%		28.07 (4.42-178.46)	**<0.001**
MELD score*	10	7-17	9	7-17	13	9-17	**0.014**	-	-
Laboratory (baseline)									
Sodium (mmol/L)	138	135-141	139	136-141	137	134-140	0.058	1.06 (0.93-1.22)	0.377
Prothrombin time (s)	13	12-17	13	12-15	15	13-18	**0.011**	-	-
Bilirubin (mg/dL)	1.1	0.6-1.9	0.9	0.5-1.5	1.4	0.8-2.0	**0.013**	-	-
Albumin (g/dL)	3.4	2.8-4	3.8	3.0-4.0	2.9	2.4-3.3	**<0.001**	-	-
Creatinine (mg/dL)	0.9	0.6-1.1	0.8	0.6-1.0	0.9	0.7-1.1	**0.010**	0.88 (0.53-1.47)	0.634
Events after diagnosis									
Any decompensation	39	25.7%	15	14.3%	24	51.1%	**<0.001**	-	-
New jaundice	27	17.8%	14	13.3%	13	27.7%	0.067	-	-

Table 1. Characteristics of patients with laboratory-confirmed chronic liver disease and COVID-19 submitted to COVIDCirrhosis.org and COVID-Hep.net reporting registries between 25th March 2020 and 20th April 2020. † = p values for univariable analyses calculated using chi-squared or Wilcoxon ranksum tests as appropriate; § = p values for multivariable analysis calculated by multiple logistic regression with the dependent variable as death and the following independent variables: age, obesity, cardiovascular disease, diabetes mellitus, hypertension, chronic liver disease status as Child-Turcotte-Pugh class, baseline serum sodium, and baseline serum creatinine. Pseudo r^2 = 0.256. * = MELD score presented is as calculated for all patients; when restricted to patients with cirrhosis, MELD was 11 (IQR 7-19) in those who survived and 14 (9-17) in those who died, p = 0.136. To explore the relationship of MELD with death, multiple logistic regression was repeated with death as the dependent variable and age, baseline MELD, obesity, cardiovascular disease, diabetes mellitus, hypertension, and baseline albumin as independent variables; here the OR for death for MELD was 1.05 (0.98-1.11) p = 0.204; other variables with p < 0.05 were age 1.05 (1.00-1.08) p = 0.038, obesity 3.61 (1.36-9.60) p = 0.010, and baseline albumin 0.97 (0.93-1.00) p = 0.029. Any decompensation defined as one or more of worsening ascites, spontaneous bacterial peritonitis, hepatic encephalopathy, or variceal haemorrhage. BMI = body mass index; CI = confidence interval; CLD = chronic liver disease; CTP = Child-Turcotte-Pugh grade; IQR = interquartile range; MELD = model for end-stage liver disease (2016 revision); OR = odds ratio.

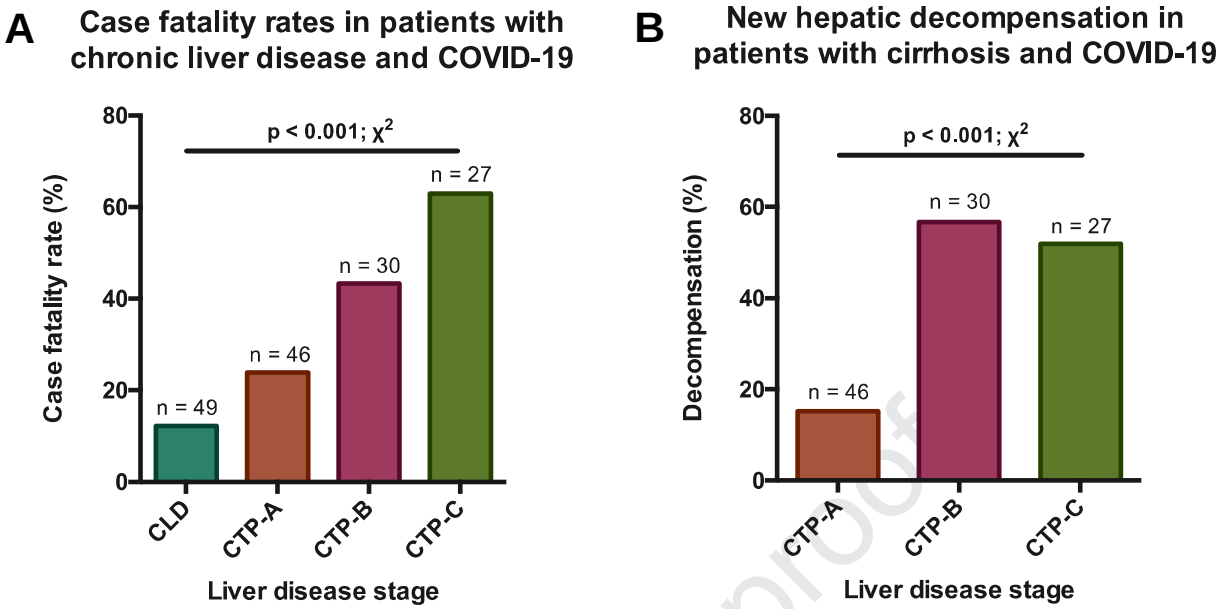

Fig. 1: Outcome in patients with non-cirrhotic chronic liver disease or cirrhosis with COVID-19. Graphs depict data from 152 submissions to COVID-Hep.net and SECURE-Cirrhosis registries submitted between 25th March 2020 and 20th April 2020. (A) Case fatality rate by liver disease stage. (B) Rates of hepatic decompensation by stage of cirrhosis (defined as one or more of new or worsened ascites, spontaneous bacterial peritonitis, new or worsened hepatic encephalopathy, or variceal haemorrhage). p values derived using chi-squared test. CLD = Chronic liver disease without cirrhosis; CTP = Child-Turcotte-Pugh stage of cirrhosis.

References:

(1) Moon AM, Singal AG, Tapper EB. Contemporary Epidemiology of Chronic Liver Disease and Cirrhosis. Clinical Gastroenterology and Hepatology 2019 Aug 8

(2) Albillos A, Lario M, Álvarez-Mon M. Cirrhosis-associated immune dysfunction: distinctive features and clinical relevance. Journal of Hepatology 2014 Dec;61(6):1385-96

(3) Boettler T, Newsome PN, Mondelli MU, Maticic M, Cordero E, Cornberg M et al. Care of patients with liver disease during the COVID-19 pandemic: EASL-ESCMID position paper. JHEP Rep 2020 Jun;2(3):100113

(4) Mehra MR, Desai SS, Kuy S, Henry TD, Patel AN. Cardiovascular Disease, Drug Therapy, and Mortality in Covid-19.N Engl J Med. 2020 May 1.

(5) Schmidt ML, Barritt AS, Orman ES, Hayashi PH. Decreasing Mortality Among Patients Hospitalized With Cirrhosis in the United States From 2002 Through 2010. Gastroenterology. 2015 May;148(5):967-977.e2.

(6) Schütte A, Ciesek S, Wedemeyer H, Lange CM. Influenza virus infection as precipitating event of acute-on-chronic liver failure. J Hepatol. 2019 Apr;70(4):797-799.

(7) Zhou F, Yu T, Du R, Fan G, Liu Y, Liu Z et al. Clinical course and risk factors for mortality of adult inpatients with COVID-19 in Wuhan, China: a retrospective cohort study. Lancet 2020 Mar 28;395(10229):1054-1062.

Supplementary appendix

List of contributors to registry from 25th March 2020 – 20th April 2020; with thanks.

Reporter / Responsible Consultant / Hospital / City / Country

Abigail Ford / Matthew Hoare, Addenbrooke's Hospital / Cambridge University Hospitals, Cambridge, UK

Ahmed Hashim / Aileen Marshall, Royal Free Hospital / London, UK

Ahmed Hashim / David Patch, Royal Free Hospital / London, UK

Ahmed Hashim / Rachel Westbrook, Royal Free Hospital / London, UK

Ahmed Hashim / Rajiv Jalan, Royal Free Hospital / London, UK

Alexandra Shingina, Vanderbilt University Medical Center, Nashville, Tennessee, USA

Andrea De Gottardi, Ente Ospedaliero Cantonale, Switzerland

Andrew Austin / Adrew Austin, Royal derby Hospital / Royal Derby Hospital, UK

Andrew Yeoman, Gwent Liver Unit / Royal Gwent Hospital, Newport, Wales, UK

Ane Soegaard Teisner, Herlev Hospital / Herlev Hospital, Denmark

Anna Crawford / Jane Collier, John Radcliffe Hospital, Oxford / John Radcliffe Hospital, Oxford, UK

Ben Hudson, Royal Devon and Exeter NHS Foundation Trust / Royal Devon and Exeter NHS Foundation Trust, UK

Benjamin Mullish / Nowlan Selvapatt, St Mary's Hospital, London, UK

Beth Lusina / Kelly Burak, Foothills Medical Centre / Peter Lougheed Centre, Calgary, Alberta, Canada

Bruno Annibale / Massimo Marignani, Ospedale Universitario S. Andrea, Sapienza / Policlinico Umberto I, Italy

Bulent Baran / Cihan Yurdaydin, Koç University Hospital, Turkey

Carmen Cerron / Martin Padilla, Transplant Departament / Guillermo Amenara Hospital, Peru

Catalina Toledo / Joan Genescà, Vall de Hebron, Spain

Costica Aloman / Donald Jensen, Rush University Medical Center, Chicago, Illinois, USA

Costica Aloman / Sheila Eswaran, Rush University Medical Center, Chicago, Illinois, USA

Costica Aloman, Rush University Medical Center, Chicago, Illinois, USA

Cristina Montón Rodriguez / Martin Prieto, Hospital Universitario La Fe de Valencia / Hospital Clínico Universitario de Valencia, Spain

Cristina Rigamonti, Division of Internal Medicine, Azienda Ospedaliero-Universitaria Maggiore della Carità , Novara, Italy, Italy

Daniel Ochoche Amedu / Dr Paul, FRSC medical centre Gwarimpa, Nigeria

David Harman / Jane Collier, Oxford University Hospitals, Oxford, UK

Elton Dajti / Mariarosa Tamè, Sant'Orsola Hospital / Sant'Orsola Hospital, Italy

Emily Glynn / John Ryan, Beaumont Hospital / Beaumont Hospital, Ireland

Emma Avitabile / Elisa Pose, Hospital Clinic Barcelona, Spain

Esteban Fuentes Valenzuela / Julia Gómez Barquero, Hospital Universitario Rio Hortega, Spain

Ewan Forrest, Glasgow Royal Infirmary, UK

Felipe Alconchel / Pablo Ramírez, Virgen de la Arrixaca University Hospital, Spain

Feng Su / Charles Landis, Harborview Medical Center / Harborview Medical Center, USA

Feng Su / Charles Landis, Harborview Medical Center / Providence Swedish, USA

Feng Su / Michele Goodman, University of Washington Northwest Hospital / Harborview Medical Center, USA

Feng Su / Paula Cox-North, Harborview Medical Center / Harborview Medical Center, USA

Feng Su, Harborview Medical Center / Harborview Medical Center, USA

Francesca Saffioti / Jeremy Cobbold, Oxford University Hospitals, Oxford / Horton General Hospital, UK

Gloria Torres / Joan Genescà, Hospital Vall d'Hebron, Spain

Gupse Adali, University of Health Sciences, Umraniye Training and Research Hospital, Istanbul, Turkey, Turkey

Gwilym Webb / Jane Collier, Oxford University Hospitals, Oxford / John Radcliffe Hospitals, UK

Gwilym Webb / Jane Collier, Oxford University Hospitals, Oxford, UK

Hannes Hagström / Ammar Barakat, Karolinska University Hospital, Sweden

Hannes Hagström / Annika Bergquist, Karolinska University Hospital, Sweden

Hannes Hagström, Karolinska University Hospital / Stockholm South Hospital, Sweden

Hrishikesh Samant, Ochsner Louisiana State University Health, Shreveport, LA / Willis Knighton Medical Center (North), Shreveport, LA 71103, UK

Ignacio García-Juárez, Instituto Nacional de Ciencias Médicas y Nutricíon Salvador Zubirán, Mexico

Jihane Benhammou, University of California Los Angeles, USA

Jonathan Crisostomo / Arlinking Ong-Go, Metropolitan Medical Center / Metropolitan Medical Center, Philippines

Juozas Kupcinskas, Lithuanian University of Health Sciences / Kaunas Clinical Hospital, Lithuania

Kevin Korenblat, Washington University School of Medicine / Christian Hospital Northeast, USA

Konstantina Nikitopoulou / George Mells, Addenbrooke's Hospital / Cambridge University Hospitals, Cambridge, UK

Konstantina Nikitopoulou / Keval Naik, Addenbrooke's Hospital / Cambridge University Hospitals, Cambridge, UK

Konstantina Nikitopoulou / Matthew Hoare, Addenbrooke's Hospital / Cambridge University Hospitals, Cambridge, UK

Konstantina Nikitopoulou / Michael Allison, Addenbrooke's Hospital / Cambridge University Hospitals, Cambridge, UK

Konstantina Nikitopoulou / Michalis Kostapanos, Addenbrooke's Hospital / Cambridge University Hospitals, Cambridge, UK

Konstantina Nikitopoulou / Paul Gibbs, Addenbrooke's Hospital / Cambridge University Hospitals, Cambridge, UK

Konstantina Nikitopoulou / Victoria Snowdon, Addenbrooke's Hospital / Cambridge University Hospitals, Cambridge, UK

Lorraine Blaise / Elia Gigante, Hepatology Unit Jean Verdier Hospital, Bondy / Avicenne Hospital Bobigny, France

Lorraine Blaise / Elia Gigante, Hepatology Unit Jean Verdier Hospital, Bondy / Cochin Hospital, Paris, France

Lorraine Blaise / Nathalie Ganne, Hepatology Unit Jean Verdier Hospital, Bondy / CHI Andre Gregoire Montreuil hospital, France

Lorraine Blaise / Pierre Nahon, Hepatology Unit Jean Verdier Hospital, Bondy, France

Lorraine Blaise / Véronique Grando, Hepatology Unit Jean Verdier Hospital, Bondy / Avicenne Hospital (Bobigny 93), France

Marcella Salzano / Joan Genescà, Hospital Vall d'Hebron, Spain

Maria Andreea Catana, Beth Israel Deaconess Medical Center, Boston, Massachusetts, USA

Maria Torrens / Joan Genescà, Hospital Vall d'Hebron, Spain

Martin Prince, Manchester Royal Infirmary / Manchester, UK

Matias Estevez Escobar / Cristina Vinolo Ubina, Hospital de Poniente, Spain

Matias Estevez Escobar, Hospital de Poniente, Spain

Matthew Armstrong / Fiona Thompson, Queen Elizabeth University Hospital Birmingham, UK

Matthew Armstrong / Thamara, Queen Elizabeth University Hospital Birmingham / Whiston Hospital, UK

Matthew Armstrong, Queen Elizabeth University Hospital Birmingham / Burton Hospital, UK

Matthew Foxton, Chelsea & Westminster Hospital, UK

Michael Andrew Yu / Ram Subramanian, Emory Transplant Center, Atlanta, Georgia / Emory Johns Creek Hospital, USA

Michael Andrew Yu / Ram Subramanian, Emory Transplant Center, Atlanta, Georgia / Emory University Hospital, USA

Mohamed Elfeki / Donald Hillebrand, Iowa Methodist Medical Center / Iowa Methodist Medical Center, USA

Monica Cucco / Gianluca Svegliati Baroni, Department of Gastroenterology, Polytechnic University of Marche, Ancona, Italy / Senigallia Hospital, Italy

Nancy Reau, Rush University Medical Center / Rush University Medical Center, USA

Nneka Ufere, Massachusetts General Hospital, USA

Patricia Jones, University of Miami, Jackson, Florida, USA

Ponni Perumalswami / Charissa Chang, Mount Sinai Hospital, New York / Mount Sinai Queens, USA

Ponni Perumalswami / Charissa Chang, Mount Sinai Hospital, New York / Saint Barnabus Medical Center, USA

Ponni Perumalswami / Charissa Chang, Mount Sinai Hospital, New York, USA

Ponni Perumalswami / Gene Im, Mount Sinai Hospital, New York, USA

Ponni Perumalswami / Jawad Ahmad, Mount Sinai Hospital, New York / Mount Sinai Queens, USA

Ponni Perumalswami / Jawad Ahmad, Mount Sinai Hospital, New York, USA

Ponni Perumalswami / Jennifer Leong, Mount Sinai Hospital, New York, USA

Ponni Perumalswami / Joseph Odin, Mount Sinai Hospital, New York / Mount Sinai Brooklyn, USA

Ponni Perumalswami / Joseph Odin, Mount Sinai Hospital, New York, USA

Ponni Perumalswami / Kamron Pourmand, Mount Sinai Hospital, New York, USA

Ponni Perumalswami / Leona Kim-Schluger, Mount Sinai Hospital, New York, USA

Ponni Perumalswami / Ritu Agarwal, Mount Sinai Hospital, New York, USA

Ponni Perumalswami / Thomas Schiano, Mount Sinai Hospital, New York / Danbury Hospital/Mount SInai Hospital, USA

Ponni Perumalswami / Thomas Schiano, Mount Sinai Hospital, New York, USA

Ponni Perumalswami, Mount Sinai Hospital, New York / New York Methodist Hospital, USA

Ponni Perumalswami, Mount Sinai Hospital, New York / Wykoff, USA

Ponni Perumalswami, Mount Sinai Hospital, New York, USA

Rainer Guenther, Department of Internal Medicine/Liver Unit / Universitätsklinikum Schleswig-Holstein, Campus, ICU/Department of Internal Medicine, Germany

Raymond Rubin / Rahul Maheshwari, Piedmont Atlanta Hospital, USA

Raymond Rubin, Piedmont Atlanta Hospital / Piedmont Columbus Midtown Hospital, USA

Raymond Rubin, Piedmont Atlanta Hospital, USA

Richard Parker, Leeds Liver Unit / Leeds, UK

Roger McCorry / Neil McDougall, Royal Victoria Hospital, Belfast / Antrim Hospital, UK

Sarah Townsend / Douglas Thorburn, Royal Free Hospital / John Radcliffe, UK

Sarang Thaker / Dr. Mikolajczyk, University of Illinois, Chicago, USA

Sathish Subramanian, Massachusetts General Hospital, USA

Sheila Eswaran, Rush University Medical Center, Chicago, Illinois, USA

Sonia Blanco Sampascual / Fernando Menéndez, Hospital Universitario Basurto, Spain

Stephen Barclay, Glasgow Royal Infirmary, UK

Steve Scaglione, Maria Cabrera / Loyola University Medical Center, Maywood, Illinois, USA

Thines Karunakaran / Chirag Oza, Broomfield Hospital / Broomfield Hospital, UK

Thomas Marjot / Ramasamy, Tony Ellis / John Radcliffe Hospital, Oxford, UK

Ulrich Thalheimer, Royal Shrewsbury Hospital / Royal Shrewsbury Hospital, UK

Upkar Gill / Graham Foster, Royal London Hospital (Barts Health NHS Trust), UK

Upkar Gill / Janet Dearden, Whipps Cross University Hospital (Barts Health NHS Trust) / Whipps Cross University Hospital (Barts Health NHS Trust), UK

Upkar Gill / Janet Dearden, Whipps Cross University Hospital (Barts Helath NHS Trust), UK

Upkar Gill / Patrick Kennedy, Royal London Hospital (Barts Health NHS Trust), UK

Upkar Gill / Richard Marley, Royal London Hospital (Barts Health NHS Trust), UK

Upkar Gill / Sudeep Tanwar, Whipps Cross University Hospital (Barts Health NHS Trust), UK

Upkar Gill / Sushma Saksena, Royal London Hospital (Barts Health NHS Trust), UK

Upkar Gill / Vikram Sharma, Newham University Hospital (Barts Health NHS Trust), UK

Upkar Gill / Vikram Sharma, Royal London Hospital (Barts Health NHS Trust), UK

Upkar Gill / William Alazawi, Royal London Hospital (Barts Health NHS Trust), UK

Vanessa de Villa, The Medical City / The Medical City, Philippines

Veronica Nguyen / Geoffrey Block, Banner University Medical Center/University of Arizona, Tucson / Banner University Medical Center/University of Arizona, Tucson, USA

Wim Laleman, University Hospitals Leuven, Belgium

Xavier Verhelst, Ghent University Hospital Belgium / AZ Oudenaarde, Belgium

Xiaolong Qi / CHESS, CHESS / Hubei, China

Xiaolong Qi / CHESS, CHESS / Jiangsu, China

Xiaolong Qi / CHESS, CHESS / Tianjin, China

Xiaolong Qi / CHESS, Hubei, China

Zurabi Lominadze, University of Maryland Medical Center / University of Maryland Medical Center, USA

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