SEMMELWEIS UNIVERSITY 1769

Introduction

One in Four Patients with Gastrointestinal Bleeding

Develops Shock or Hemodynamic Instability

A Systematic Review and Meta-analysis

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Hemodynamic instability (HI) and shock are associated with untoward outcomes in **gastrointestinal bleeding** (GIB). However, there are no studies in the existing literature on the proportion of patients who developed HI or shock after gastrointestinal bleeding. We aimed to meta-analyze the available data to determine these proportions in different bleeding sources.

Methods

Results

The protocol was registered on PROSPERO in advance (CRD42021283258). A systematic search was performed in three databases (PubMed, Embase, and CENTRAL) on 14th October 2021. Pooled proportions with 95% confidence intervals (CI) were calculated with a random-effects model. A subgroup analysis was carried out based on the time of assessment (**on admission or during hospital stay**) of the investigated outcomes. Heterogeneity was assessed by Higgins and Thompson's I². The Joanna Briggs Institute Prevalence Critical Appraisal Tool was used for the risk of bias assessment.



Figure 1. PRISMA 2020 flow chart of the screening and selection process of the studies

We identified 11,589 records, of which 220 studies were eligible for data extraction. The overall proportion of shock and hemodynamic instability in gastrointestinal bleeding patients was 0.25 (CI: 0.17–0.36). In non-variceal bleeding, the proportion was 0.22 (CI: 0.14–0.31), whereas it was 0.25 (CI: 0.19–0.32) in variceal bleeding. The proportion of patients with colonic diverticular bleeding who developed shock or HI was 0.12 (CI: 0.06–0.22). The risk of bias was low, and heterogeneity was high in all analyses.

Study	Event	GIB		Proportion	95% Cl	Study Eve	t NVUGIB		Proportion	95% CI	Study Event	VUGIB		Proportio	n 95% Cl	Study	Event	LGIB		Proportio	n 95% Cl
Hemodynamic instability on a Van Weyenberg et al. 2012 Ballester-Clau et al. 2018 Yap et al. 2013 Mehta et al. 2015 Parker et al. 2017 Overall effect (random mode $l^2 = 87\%$ [71%; 94%]	admission 8 19 27 19 78 I) 151	56 86 95 48 161 446		0.14 0.22 0.28 0.40 0.48 0.29	[0.07; 0.26] [0.15; 0.32] [0.20; 0.38] [0.27; 0.54] [0.41; 0.56] [0.12; 0.56]	Hemodynamic instability on admissionBunchorntavakul et al. 201719Gao et al. 201929Rotondano et al. 201424Baracat et al. 202039Ahn et al. 201639Gonzalez-Gonzalez et al. 201128Morsy et al. 201421Maggio et al. 201320Elsebaey et al. 201859Overall effect (random model)72	180 230 2398 39 158 1067 93 61 125 4351		0.08 0.09 0.10 0.23 0.25 0.27 0.29 0.43 0.44 0.21	$\begin{bmatrix} 0.05; \ 0.13 \\ 0.06; \ 0.14 \end{bmatrix} \\ \begin{bmatrix} 0.09; \ 0.11 \\ 0.12; \ 0.39 \end{bmatrix} \\ \begin{bmatrix} 0.19; \ 0.32 \\ 0.24; \ 0.30 \end{bmatrix} \\ \begin{bmatrix} 0.24; \ 0.30 \\ 0.31; \ 0.55 \end{bmatrix} \\ \begin{bmatrix} 0.36; \ 0.53 \\ 0.12; \ 0.36 \end{bmatrix}$	Hemodynamic instability on admiss Bunchorntavakul et al. 2017 17 Gado et al. 2014 39 Ismail et al. 2008 256 Elsebaey et al. 2018 107 Overall effect (random model) 419 $t^2 = 98\%$ [97%; 99%] 419 Hemodynamic instability during ho 53 Farooqi et al. 2018 34	sion 106 224 420 161 911 spitalizatio 115 66		0.16 0.17 0.61 0.66 0.38 0.21 0.52	[0.10; 0.24] [0.13; 0.23] [0.56; 0.65] [0.59; 0.73] [0.12; 0.73] [0.14; 0.29] [0.40; 0.63]	Hemodynamic instability Radaelli et al. 2021 Rios et al. 2007 Yap et al. 2013 Overall effect (random mo $l^2 = 83\%$ [48%; 94%] Hemodynamic instability	on admiss 110 29 4 odel) 143 during hor	ion 1198 171 19 1388 spitalization		0.09 0.17 0.21 <mark>0.14</mark>	[0.08; 0.11] [0.12; 0.23] [0.08; 0.44] [0.01; 0.81]
Hemodynamic instability dur Cangemi et al. 2017 Hampers et al. 2002 Lee et al. 2012 Mohan et al. 2018 Overall effect (random mode $l^2 = 93\%$ [86%; 97%]	ring hospital 26 39 30 51 I) 146	zation 163 124 83 86 456	# 	0.16 0.31 0.36 0.59 0.34	[0.11; 0.22] [0.24; 0.40] [0.27; 0.47] [0.49; 0.69] [0.11; 0.68]	$l^2 = 97\% [96\%; 98\%]$ Hemodynamic instability during hospitaliz Hwang et al. 2016 156 Kwon et al. 2018 26 Shock on admission	ation 1584 46		0.10 0.57	[0.08; 0.11] [0.42; 0.70]	Shock on admission Siddiqui et al. 2019 3330 Kim J et al. 2021 128 Lai et al. 2018 43 Fallatah et al. 2012 22 Thomopoulos et al. 2006 26 Kim S et al. 2017 49 Maiwall et al. 2012 90 Viirano et al. 2012 90	63036 1573 324 125 141 264 214 349		0.05 0.08 0.13 0.18 0.18 0.19 0.20 0.26	[0.05; 0.05] [0.07; 0.10] [0.10; 0.17] [0.12; 0.25] [0.13; 0.26] [0.14; 0.24] [0.15; 0.25] [0.21; 0.31]	Niikura et al. 2020 Arroja et al. 2011 Nykänen et al. 2018 Abbas et al. 2005 Albeldawi et al. 2014 Bua-ngam et al. 2017 Klinvimol et al. 1994 Foley et al. 2010	5 105 24 46 30 21 6 13	159 371 53 88 57 38 10 20		0.03 0.28 0.45 0.52 0.53 0.55 0.60 0.65	[0.01; 0.07] [0.24; 0.33] [0.33; 0.59] [0.42; 0.62] [0.40; 0.65] [0.40; 0.70] [0.31; 0.83] [0.43; 0.82]
Shock on admission Stabat et al. 1998 Nagata et al. 2017 Robert et al. 2006 Oprita et al. 2018 Overall effect (random model $l^2 = 92\%$ [82%; 96%]	8 62 80 232 I) 382	46 314 223 610 1193		0.17 0.20 0.36 0.38 0.27	[0.09; 0.31] [0.16; 0.25] [0.30; 0.42] [0.34; 0.42] [0.08; 0.60]	Lai et al. 2018 11 Wierzchowski et al. 2013 93 Wang et al. 2009 24 Restellini et al. 2013 533 Sey et al. 2019 160 Jairath et al. 2012 994 Edmunds et al. 1988 14 Di Felice et al. 1987 23 Chirapongsathorn et al. 2021 34 Overall effect (random model) 3643	118 482 129 1677 4474 2709 28 40 431 10088		0.09 0.19 0.22 0.32 0.36 0.37 0.50 0.58 0.79 0.36	[0.05; 0.16] [0.16; 0.23] [0.30; 0.34] [0.34; 0.37] [0.35; 0.39] [0.33; 0.67] [0.42; 0.72] [0.75; 0.83] [0.21; 0.53]	Villandeva et al. 1999 27 Naeshiro et al. 2014 18 Hassanien et al. 2018 208 Ardevol et al. 2018 187 Villanueva et al. 2016 58 Kim D et al. 2018 194 Tsai et al. 2019 59 Tsai et al. 2014 71 Hermie et al. 2018 14 Chirapongsathorn et al. 2021 517 Overall effect (random model) 5083 $l^2 = 100\% [100\%; 100\%]$ 50	100 63 725 646 179 454 131 157 30 713 69224		0.27 0.29 0.29 0.32 0.43 0.45 0.45 0.45 0.47 0.73 0.26	[0.19; 0.36] [0.19; 0.41] [0.26; 0.32] [0.26; 0.33] [0.26; 0.40] [0.38; 0.47] [0.37; 0.54] [0.38; 0.53] [0.30; 0.64] [0.69; 0.76] [0.18; 0.36]	Hermie et al. 2021 García et al. 2001 Overall effect (random mo $l^2 = 94\%$ [90%; 96%] Shock on admission Oakland et al. 2018 Li et al. 2020	58 42 idel) 350 58 4115	82 50 928 2528 124620		0.71 0.84 0.49 0.02 0.03	[0.60; 0.80] [0.71; 0.92] [0.27; 0.71] [0.02; 0.03] [0.03; 0.03]
Shock during hospitalization Siddiqui et al. 2019 Trebicka et al. 2021 Konecki et al. 2021 Nishida et al. 2017 Nishida et al. 1992 Catano et al. 2021 Overall effect (random model $l^2 = 99\%$ [99%; 100%]	137406 64 25 2 27 64 I) 137524 64	11838 216 16 69 141 12280		0.02 0.12 0.39 0.45 0.15	[0.02; 0.02] [0.08; 0.17] [0.02; 0.37] [0.28; 0.51] [0.37; 0.54] [0.05; 0.36]	$l^2 = 98\% [97\%; 98\%]$ Shock during hospitalization Siddiqui et al. 2019 7785 Park et al. 2016 19 Abougergi et al. 2017 1176 Nguyen et al. 2010 92' Zhang et al. 2010 47 Overall effect (random model) 9060 $l^2 = 100\% [100\%; 100\%]$	3127786 539 227480 7260 223 3363288		0.02 0.04 0.05 0.13 0.21 0.07	[0.02; 0.03] [0.02; 0.05] [0.05; 0.05] [0.12; 0.14] [0.16; 0.27] [0.02; 0.18]	Shock during hospitalization Singal et al. 2012 798 Bilal et al. 2019 198 Vuachet et al. 2015 14 Park et al. 2016 20 Senosiain et al. 2016 12 Sung et al. 1995 18 Liu T et al. 2006 9 Liu Y et al. 2009 3 Thomas et al. 1992 48 Lee et al. 1992 59	27422 2003 121 164 68 94 42 14 101 101		0.03 0.10 0.12 0.12 0.18 0.19 0.21 0.21 0.21 0.48 0.58	[0.03; 0.03] [0.09; 0.11] [0.07; 0.19] [0.08; 0.18] [0.10; 0.29] [0.12; 0.28] [0.11; 0.36] [0.07; 0.48] [0.38; 0.57] [0.49; 0.68]	Shock during hospitalizat Siddiqui et al. 2019 Lv et al. 2019	ion 56226 21	3221016 🔳 31		0.02 0.68	[0.02; 0.02] [0.50; 0.82]
Overall effect (random model Prediction interval $I^2 = 100\% [100\%; 100\%]$ Residual heterogeneity: $I^2 = 98\%$ Test for subgroup differences: x_3^2	i) 138203 6 4 [98%; 99%] = 1.15, df = 14	14375 0 (<i>p</i> = 0.36)	0.2 0.4 0.6 0.8	0.25	[0.17; 0.36] [0.04; 0.73]	Overall effect (random model)9515Prediction interval $l^2 = 100\% [100\%; 100\%]$ Residual heterogeneity: $l^2 = 100\% [100\%; 100\%]$ Test for subgroup differences: $x^2_3 = 5.42$, df = 21 (μ)	3379357 0%] < 0.01)	0 0.2 0.4 0.6 0.8	0.22	[0.14; 0.31] [0.02; 0.76]	Overall effect (random model)1179 $l^2 = 99\%$ [99%; 99%]6739Overall effect (random model)6739Prediction interval $l^2 = 100\%$ [99%; 100%]Residual heterogeneity: $l^2 = 99\%$ [99%; 99%Test for subgroup differences: $x_3^2 = 1.35$, df	30130 100446 -] 0 = 30 (ρ = 0.2	0.2 0.4 0.6 0.8	0.18 0.25 1	[0.10; 0.30] [0.19; 0.32] [0.04; 0.73]	Overall effect (random mode Prediction interval $J^2 = 100\% [100\%; 100\%]$ Residual heterogeneity $J^2 = 96$ Test for subgroup differences:	 60913 % [94%; 97° x²₃ = 5.05, 	3350511	2 0.4 0.6 0.8 1	0.27	[0.13; 0.49] [0.01; 0.95]

Figure 2. Forest plot demonstrating the proportion rates for hemodynamic instability and shock in unspecified gastrointestinal bleeding sources. GIB, gastrointestinal bleeding; CI, confidence interval

Figure 3. Forest plot demonstrating the proportion rates for hemodynamic instability and shock in non-variceal bleeding. NVUGIB, non-variceal upper gastrointestinal bleeding; CI, confidence interval

Figure 4. Forest plot demonstrating the proportion rates for hemodynamic instability and shock in variceal bleeding. VUGIB, variceal upper gastrointestinal bleeding; CI, confidence interval

Figure 5. Forest plot demonstrating the proportion rates for hemodynamic instability and shock in lower gastrointestinal bleeding sources. LGIB, lower gastrointestinal bleeding; CI, confidence interval



One in five, one in four and one in eight patients develops shock or hemodynamic instability on admission or during the hospital stay in the case of non-variceal, variceal and colonic diverticular bleeding, respectively. Patients need a more proactive treatment strategy and require continuous monitoring to prevent untoward outcomes.



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