Research Article

Frequency of Thrombocytopenia and its Association with Short-Term Outcomes among ICU Patients

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Abstract: Background: Thrombocytopenia can result from various etiologies. The development of thrombocytopenia in critically ill patients is associated with increased bleeding and transfusion risk and, hence, higher mortality.

Objective: To determine the frequency of thrombocytopenia and its association with short-term outcomes in patients admitted to the Medical ICU of the tertiary care center.

Materials and Methods: A prospective observational study was conducted in the Medical Intensive Care Unit (MICU) at The Indus Hospital, Karachi, from March to September 2023. The study obtained the permission from the Ethical Review Board of Indus Hospital (IRB#: IHHN_IRB_2023_01_022). Each patient was followed with a platelet count on the first, third, fifth, and seventh day. Patients' outcomes in terms of aliveness or death were noted on the first, third, fifth, and seventh days.

Result: The study included 152 patients with a mean age of 42.50 ± 18.11 years. On admission, thrombocytopenia was seen in 42%. The frequency at day 3, day 5, and day 7 was 50%, 56.1%, and 50.4%, respectively. At day 5, a significant association was found between mortality and thrombocytopenia, with 68.5% mortalities among thrombocytopenia patients and 31.5% mortality among patients without thrombocytopenia (p=0.002). The association becomes even more obvious by day 7, where thrombocytopenia was found to be strongly linked to mortality, with a higher mortality rate of 68% among those with thrombocytopenia than a 31% death rate among those without thrombocytopenia (p<0.001).

Conclusion: Thrombocytopenia was common in MICU and correlated with short-term mortality. The findings indicate the prognostic role of platelet count. To confirm these findings, more multicenter investigations with a bigger sample size and modified analysis are required.

Keywords: Critical care, Intensive care, Mortality, Platelet count, Thrombocytopenia, Vascular endothelium.

INTRODUCTION

The platelet count is dynamic, with approximately 150 billion platelets produced daily by bone marrow. Under normal circumstances, the interplay amongst clotting factors, platelets, and the vascular endothelium maintains the integrity of the circulatory system [1, 2].

Thrombocytopenia can result from various etiologies. Conditions involving either decreased thrombocyte production (central causes that interfere with bone marrow function) or increased turnover (peripheral causes, which can be immune- and non-immune causes, such as splenic sequestration) or iatrogenic causes (invasive procedures, medications, such as antibiotics, inotropes, and vasopressors, and hemodilution) are the most common causes of thrombocytopenia [3-6].

Classification of thrombocytopenia is based on platelet count. Mild thrombocytopenia is with a platelet count ranging between 101×10^3 and $140\times10^3/\mu L$. Moderate thrombocytopenia is characterized by a platelet count between $51\times10^3/\mu L$ and $100\times10^3/\mu L$, and severe thrombocytopenia is termed when the platelet count is $50\times10^3/\mu L$ or falls below it. The incidence of severe thrombocytopenia in critically sick patients is linked to elevated risk of bleeding and thereby transfusion, in contrast to the patients with platelet count $>150 \times 10^9/L$ [7-10].

Multiple studies that are conducted to observe the relationship of thrombocytopenia in patients with serious illness show an indirect relationship between low platelet counts and morbidity (sepsis, DIC, bleeding, prolonged ICU stay, and ARDS) and mortality. Variation in severity of thrombocytopenia may occur in septic DIC patients, and severity of the thrombocytopenia and mortality are believed to be linked to the magnitude of the drop in platelet count [11- 13].

In Pakistan, to our best knowledge, the data about the frequency of thrombocytopenia in patients of Medical ICUs of different tertiary care centers in Pakistan is unavailable. International data does not apply to our local population due to differences in baseline characteristics and living standards. This study aims to be the first step towards establishing recent local data in Pakistan about the frequency of thrombocytopenia and its association with short-term outcomes in patients admitted to a MICU of a tertiary care hospital.

MATERIALS AND METHODS

This prospective observational study was carried out among

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patients who were admitted to the Medical Intensive Care Unit (MICU) of The Indus Hospital, Karachi. The hospital is among the largest tertiary care facilities in Karachi, Pakistan, and the study duration extended from March 2023 to September 2023. The study was permitted by the Ethical Review Board of Indus Hospital (IRB#: IHHN_IRB_2023_01_022). Caregivers of patients were informed about the study aim, with written informed consent taken from them willing to take part in this study. All adult patients (15-79 years) admitted to the Medical ICU, irrespective of diagnosis, were included in the study. However, patients with hematological disorders, pregnant women, and patients who had undergone chemotherapeutic or radiotherapy or were admitted with an admitting diagnosis of major trauma were excluded.

The sample size for the present study was determined through an online calculator (OpenEpi), for a reported frequency of thrombocytopenia in ICU patients of 37.57% with 95% confidence and an 8% margin of error. The estimated minimum required sample size was 141. But 150 patients were included in the study [14].

Thrombocytopenia was defined as a platelet count of <100,000 platelets/μL [1]. Patients' outcomes in terms of alive or dead were noted during the 1st day, 3rd day, 5th day, and 7th day. The patient was followed with a platelet count on the 1st day, 3rd day, 5th day, and 7th day. Platelets were transfused when platelet counts were transfused based on hospital protocol and clinical guidelines. Data was collected on a pre-designed proforma.

STATISTICAL EVALUATION

Data was entered and analyzed using SPSS version 26. Mean (SD)/ Median (IQR) was computed for age and formal years of education as appropriate. Quantitative variables are reported as mean and standard deviation or median (IQR) based on the normality of the data. Normality was assessed by using the Shapiro-Wilk test. Qualitative variables were reported as frequency and percentage. Associations were estimated using the chi-square or Fisher-exact test among qualitative data, while quantitative data was compared employing an independent sample t-test. P-value ≤0.05 was taken as statistically significant.

RESULT

A total of 152 patients were studied, who had a mean age of 42.50 ± 18.11 years. Gender proportion was almost equal, with 50.7% male and 49.3% female proportion. Patients presented with comorbidities of hypertension, diabetes, ischemic heart disease, and heart failure. Of the 54 patients who received transfusions, 35 (64.8%) received platelet transfusions, either alone or in combination, which was strongly associated with thrombocytopenia; 27 patients (50%), on the other hand, received PRBCs, and 17 patients (31.5%) received fresh frozen plasma (FFP); on the other hand, 37% received only one blood product, and 63% received combinations of two or more products. Table **1** displays socio-demographic and clinical features of study participants.

Table 1. Summary of Patients' Demographic and Clinical Features (n=152).

Variables	Groups	Frequency	Percentage
Age	≤40 years	76	50%
	>40 years	76	50%
Gender	Male	77	50.7%
	Female	75	49.3%
Comorbidity	Hypertension	37	24.3%
	Diabetes	38	25%
	Ischemic Heart Disease	18	11.8%
	Heart Failure	2	1.3%
Medications	Vasopressor	46	30.3%
	Antibiotics	102	67.1%
	Antiviral	98	64.5%
	Corticosteroids	33	21.7%
Management	Intubation	103	67.7%
	Need of inotropic support	101	66.4%
	Sedation	92	60.5%
	Blood Transfusion	54	35.5%

The frequency of thrombocytopenia during ICU stay is depicted in Fig. (**1**). On admission, thrombocytopenia was seen in 42%. The frequency rose to 50% at day 3. The cumulative frequency was seen in more than half patients at day 5 (56.1%), which was then reduced to 50.4% on day 7.

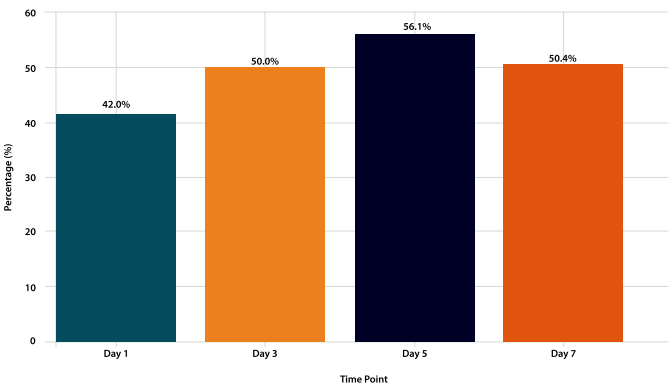

Fig. (1). Frequency of Thrombocytopenia.

Table **2** compares patients' features between those with and without thrombocytopenia. Patients did not differ based on age (p=0.182) and gender (p=0.645). Among different comorbidities, the frequency of diabetes was significantly lower who developed thrombocytopenia (0.004). Use of vasopressors (p<0.001) and antibiotics (p=0.010) was higher among thrombocytopenic patients. Need for ionotropic support (p<0.001), sedatives (p=0.049), and blood transfusion (p<0.001) was also significantly higher among patients with thrombocytopenia at Day 7.

Table 2. Comparison of Patients' Features with and without Thrombocytopenia at Day 7 (n=152).

Variables	Groups	Thrombocytopenia		p-Value
		No n (%)	Yes n (%)	
Age	≤40 years	25 (43.1)	51 (54.26)	0.182¥
	>40 years	33 (56.9)	43 (45.74)	
Gender	Male	28 (48.28)	49 (52.13)	0.645¥
	Female	30 (51.72)	45 (47.87)	
Comorbidity	Hypertension	19 (32.76)	18 (19.15)	0.058¥
	Diabetes	22 (37.93)	16 (17.02)	0.004¥*
	Ischemic Heart Disease	8 (13.79)	10 (10.64)	0.559¥
Medications	Vasopressors	28 (50.91)	74 (79.57)	<0.001¥*
	Antibiotics	54 (93.1)	94 (100)	0.010α*
	Antiviral	11 (20.75)	17 (23.29)	0.736¥
	Corticosteroids	33 (56.9)	70 (75.27)	0.062¥
Management	Intubation	33 (56.9)	70 (75.27)	0.018¥*
	Need of Ionotropic Support	41 (70.69)	79 (84.04)	<0.001¥*
	Sedation	29 (50.88)	63 (67.02)	0.049¥*
	Blood Transfusion	10 (17.24)	44 (47.83)	<0.001¥*

¥ Chi-Square; α Fischer Exact Test; * Statistically Significant at p<0.05.

ICU stay and overall hospital stay were significantly higher among those with thrombocytopenia at Day 7. The need of RRT was higher in patients with thrombocytopenia but it did not reach to statistical significance (p=0.137) (Table **3**).

Table 3. Comparison of RRT and Length of Stay among with and without Thrombocytopenia at Day 7 (n=152).

Variables	Groups	Thrombocytopenia		p-value
		No n(%)	Yes n(%)	
Need of RRT	Yes	10 (18.18)	26 (29.21)	0.137¥
	No	45 (81.82)	63 (70.79)	
MICU Stay (days)#	-	3 (2-6)	6 (3-7.25)	0.014€*
Hospital Stay (days)#	-	7.5 (7-12)	8 (7-12.5)	0.742€

#: Non-normal data is presented as median with inter-quartile range, RRT: Renal Replacement Therapy; MICU: Medical intensive Care Unit; ¥ Chi-Square; * Statistically Significant at p<0.05.

Among thrombocytopenia patients, the mortality rate at day 1 was 43.4%, which was not significantly different than those who had no thrombocytopenia (56.6%) (p=0.741). At day 3, mortality among thrombocytopenia patients was 46.3%, whereas death rate was 43.7% among those who had no thrombocytopenia at day 3 (p=0.250). At day 5, a significant association was found between mortality and thrombocytopenia, with 68.5% mortalities among thrombocytopenia patients and 31.5% mortality among patients without thrombocytopenia (p=0.002). The association becomes even more obvious by day 7, where thrombocytopenia was found to be linked to mortality, with a higher mortality rate of 68% among those with thrombocytopenia than a 31% death rate among those without thrombocytopenia (p<0.001) (Table **4**).

Table 4. Association of Mortality with Thrombocytopenia during Hospital Stay.

Thrombocytopenia	Mortality		Total	p-value
	Yes	No		
Thrombocytopenia at Day 1 (n=150)				
Yes	36(43.4)	27(40.3)	63(42)	0.741
No	47(56.6)	40(59.7)	87(58)	
Thrombocytopenia at Day 3 (n=150)				
Yes	47(46.3)	31(46.3)	78(50)	0.250
No	36(43.7)	36(53.7)	72(48)	
Thrombocytopenia at Day 5 (n=139)				
Yes	50(68.5)	28(42.4)	78(56.1)	*0.002
No	23(31.5)	38(57.6)	61(43.9)	
Thrombocytopenia at Day 7 (n=127)				
Yes	44(68.8)	20(31.7)	64(50.4)	*0.001
No	20(31.3)	43(68.3)	63(49.6)	

*Significant at p<0.05.

DISCUSSION

The present study found that thrombocytopenia was seen in 42% upon admission to the MICU. The frequency rose to 50% at day

3. The cumulative frequency was seen in more than half patients at day 5 (56.1%), which was then reduced to 50.4% on day 7. These patterns show how platelet abnormalities in critically ill patients are dynamic and evolve.

Studies conducted in both international and local settings have revealed varying incidence, which may be because of variations in patient characteristics, intensive care unit admission requirements, and the coexistence of other diseases. A study performed by Khurana *et al.* in India reported that 78% of patients had thrombocytopenia on admission, whereas 2% developed it during their stay in the ICU [14]. On the other hand, another Indian study reported a higher rate of thrombocytopenia, which was developed in 81.2% during admission to the ICU but they did not demonstrate thrombocytopenia burden day-wise [15]. Studies performed in higher-resource settings reported lower thrombocytopenia burden [16, 17]. A study by Samsung Medical Center, Seoul, Korea, found that 43% of patients had thrombocytopenia upon admission, while 37.1% had new-onset thrombocytopenia [16]. In A study of the University Hospital Gasthuisberg, Belgium, 41.3% of patients had thrombocytopenia, longer ICU stay (8 [4-16] days vs. 5 [2-9] days) and higher ICU mortality (33.8% vs18%) and higher bleeding events (21.4% in those who had platelet count above $>100 \times 10^9$ to 52.6% in those who had less than 100×10 9 as compared to 8% in those patients who had normal platelets counts daily [17].

In the present study, at day 5, a significant association was found between mortality and thrombocytopenia, with 68.5% mortalities among thrombocytopenia patients and 31.5% mortality among patients without thrombocytopenia. The association becomes even more noticeable by day 7, where thrombocytopenia was found to be linked to mortality (68.8% of those with thrombocytopenia, 31.3% compared to those without thrombocytopenia). A blunted or absent rise in platelet count in critically ill patients is associated with increased mortality [18]. Despite the significance of these relationships, we must consider how they affect actual treatment. We shouldn't make snap judgments without considering the whole picture just because someone has a low platelet count. This covers issues such as erratic blood pressure, malfunctioning organs, or pre-existing medical conditions. Even if a modest p-value may indicate a strong correlation, we must consider the magnitude of the effect and whether it affects how we treat patients. For instance, a slight variation in platelet counts between groups may be substantial, yet it may not have a meaningful impact on patient outcomes or our approach to their care.

International research shows that low platelet counts can predict outcomes. According to a study conducted in many French hospitals, a 30% or greater decline in platelet counts alone was associated with an increased risk of death [14]. This demonstrates that tracking platelet levels over time is preferable to focusing just on one-time readings. Accordingly, Kongmee I and associates demonstrated that patients with lower platelet counts at admission had a reduced chance of surviving [19]. According to a study from the University of Erlangen-Nuremberg in Germany, 31% of patients who had low platelet counts also passed away. 46.4% of patients in critical care had low platelet counts at some point, according to Canadian data, and 23.8% had thrombocytopenia at the time of ICU admission [20].

Although thrombocytopenia may be another indicator of the disease's severity, the study's findings also imply that it may be a sign of potential ongoing systemic deterioration, though it should be noted that this could provide insight into the entire clinical picture [21]. A persistently low platelet count and the duration of thrombocytopenia in such critical patients of the ICU are crucial for prognosis [22-25]. Rarely seen in the regional literature, our study provides a day-by-day profile of the development of thrombocytopenia and its effects on outcomes. Clinicians may have a better understanding of specific degradation periods or possible windows for observation or intervention thanks to this temporal mapping.

LIMITATIONS

This research has limitations. The study was conducted in an urban context at a single tertiary care facility, which restricts the findings' applicability in other healthcare environments. This study simply assesses the burden of thrombocytopenia but does not focused on determining its severity. Because of the small sample size, our statistical power might have been impacted, especially when comparing subgroups. To prevent overfitting, we deliberately avoided developing a multi-variable approach based on data and event frequency and instead concentrated on univariate comparisons to illustrate the change in platelets over time, even though our study permitted prospective determination of platelet trends and outcomes over the first seven days of ICU admission. Confounding factors might not have been properly taken into account, even though an exploratory study using this methodology to show temporal trends was sufficient. To separate independent relationships with mortality and thrombocytopenia burden each day, multi-variable modeling techniques might be more appropriate for future studies with a bigger, multi-center cohort.

CONCLUSION

Thrombocytopenia was common in MICU and correlated with short-term mortality. The findings indicate the prognostic role of platelet count. To confirm these findings, more multicenter investigations with a bigger sample size and modified analysis are required.

AUTHORS' CONTRIBUTION

Waqas Siddiqui: Conceptualization, Study design, Methodology, Data analysis and interpretation, Writing draft, Critical review and revision the manuscript, Final approval, final proof to be published.

Fizvia Farooq Hereker: Conceptualization, Critical review and revision the manuscript.

Abdul Nafay Kazi: Study design, Writing draft,

Muzeer Ahmed: Writing draft.

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Declared none.

ETHICAL DECLARATIONS

Data Availability Statement

Data are available upon reasonable request. The data used to support the findings of this study are available from the corresponding author upon request.

Ethical Approval

The study was permitted by the Ethical Review Board of Indus Hospital (IRB#: IHHN_IRB_2023_01_022).

Consent to Participate

Informed consented.

Consent for Publication

Consented.

Conflict of Interest

Declared none.

Competing Interest/Funding

Declared none.

Use of AI-Assisted Technologies

The authors declare that no generative artificial intelligence (AI) or AI-assisted technologies were utilized in the writing of this manuscript, in the creation of images/graphics/tables/captions, or in any other aspect of its preparation.

REFERENCES

[1] Jinna S, Khandhar PB. Thrombocytopenia. Treasure Island (FL): StatPearls Publishing 2025. Available from: https://www.ncbi.nlm.nih.gov/books/NBK542208/

[2] Santoshi RK, Patel R, Patel NS, Bansro V, Chhabra G. A comprehensive review of thrombocytopenia with a spotlight on intensive care patients. Cureus 2022; 14(8): e27718.

[3] Jonsson AB, Rygård SL, Hildebrandt T, Perner A, Møller MH, Russell L. Thrombocytopenia in intensive care unit patients: A scoping review. Acta Anaesthesiol Scand 2021; 65(1): 2-14.

[4] Raadsen M, Du Toit J, Langerak T, van Bussel B, van Gorp E, Goeijenbier M. Thrombocytopenia in virus infections. J Clin Med 2021; 10(4): 877. doi: 10.3390/jcm10040877.

[5] Reizine F, Aubron C. What really matters with thrombocytopenia: Absolute value, timing, etiology or management?. Intensive Care Med 2024; 50(2): 304-5.

[6] Bayraktar YŞ, Açıkgöz A, Eyiol H, Bayram HH, Kara İ, Duman A, *et al.* The incidence of thrombocytopenia and its association with mortality in patients with sepsis followed in intensive care unit. Eurasian J Emerg Med 2023; 22(1): 24-7.

[7] Gonzalez DA, Kumar R, Asif S, Bali A, Dang AK. Sepsis and thrombocytopenia: A nowadays problem. Cureus 2022; 14(5): e25421.

[8] Hariri G, Belossi V, Perol L, Missri L, Gabarre P, Bonny V, *et al.* Prospective evaluation of bleeding risk among thrombocytopenic patients admitted in intensive care unit. J Crit Care 2024; 79: 154405.

[9] Hiensch RJ, Lee A. Coagulopathy and thrombocytopenia. In: Mayer SA, Shapiro JM, Gidwani UK, Oropello JM, Eds. Mount Sinai Expert Guides: Critical Care. USA: Wiley 2021; pp. 561-74.

[10] Lillemäe K, Luostarinen T, Reinikainen M, Bendel S, Laitio R, Hoppu S, *et al.* Early thrombocytopenia is associated with an increased risk of mortality in patients with traumatic brain injury treated in the intensive care unit: A Finnish Intensive Care Consortium study. Acta Neurochir (Wien) 2022; 164(10): 2731-40.

[11] Zarychanski R, Houston DSJH, the American Society of Hematology Education Program Book. Assessing thrombocytopenia in the intensive care unit: The past, present, and future. Am Soc Hematol Educ Prog 2017; 2017(1): 660-6.

[12] Ostadi Z, Shadvar K, Sanaie S, Mahmoodpoor A, Saghaleini SH. Thrombocytopenia in the intensive care unit. Pak J Med Sci 2019; 35(1): 282-7. doi: 10.12669/pjms.35.1.19.

[13] Zhao C, Qin Z, Tang Y, Liu L, Li Y, He Q, *et al.* Association between platelets and in-hospital mortality in critically ill patients with tumours: A retrospective cohort study. BMJ Open 2022; 12(4): e053691. doi: 10.1136/bmjopen-2021-053691.

[14] Khurana D, Deoke SA. Thrombocytopenia in critically Ill patients: Clinical and laboratorial behavior and its correlation with short-term outcome during hospitalization. Indian J Crit Care Med 2017; 21(12): 861-4. doi: 10.4103/ijccm.IJCCM_279_17.

[15] Ilkhan G, Celikhisar H. Thrombocytopenia and its effect on mortality and morbidity in the intensive care unit. J Surg Med 2021; 5(1): 31-5.

[16] Zhou Z, Xie Y, Feng T, Zhang X, Zhang Y, Jin W, *et al.* [Clinical predictive value of short-term dynamic changes in platelet counts for prognosis of sepsis patients in intensive care unit: A retrospective cohort study in adults]. Zhonghua Wei

Zhong Bing Ji Jiu Yi Xue 2020; 32(3): 301-6. doi: 10.3760/cma.j.cn121430-20190909-00069.

[17] Moreau D, Vesin A, Garrouste-Orgeas M, de Lassence A, Zahar J-R, Adrie C, *et al.* Platelet count decline: An early prognostic marker in critically ill patients with prolonged ICU stays. Chest 2007; 131(6): 1735-41.

[18] Lim SY, Jeon EJ, Kim HJ, Jeon K, Um SW, Koh WJ, *et al.* The incidence, causes, and prognostic significance of new-onset thrombocytopenia in intensive care units: A prospective cohort study in a Korean hospital. J Korean Med Sci 2012; 27(11): 1418-23. doi: 10.3346/jkms.2012.27.11.1418. Epub 2012 Oct 30. PMID: 23166427;

[19] Kongmee I, Norasetthada L, Tantiworawit A, Chai-Adisaksopha C, Rattanathammethee T, Hantrakool S, *et al.* Prevalence, causes and outcomes of thrombocytopenia among patients in medical intensive care units. J Hematol Transfus Med 2023; 33: 129-36.

[20] Vanderschueren S, De Weerdt A, Malbrain M, Vankersschaever D, Frans E, Wilmer A, *et al.* Thrombocytopenia and prognosis in intensive care. Crit Care Med 2000; 28(6): 1871-6. doi: 10.1097/00003246-200006000-00031.

[21] Strauss R, Wehler M, Mehler K, Kreutzer D, Koebnick C, Hahn EG. Thrombocytopenia in patients in the medical intensive care unit: Bleeding prevalence, transfusion requirements, and outcome. Crit Care Med 2002; 30(8): 1765-71. doi: 10.1097/00003246-200208000-00015.

[22] Crowther MA, Cook DJ, Meade MO, Griffith LE, Guyatt GH, Arnold DM, *et al.* Thrombocytopenia in medical-surgical critically ill patients: Prevalence, incidence, and risk factors. J Crit Care 2005; 20(4): 348-53. doi: 10.1016/j.jcrc.2005.09.008.

[23] Nijsten MW, Tulleken JE, Vd Werf TS, Zijlstra JG. Absence of secondary thrombocytosis is associated with prolonged ICU-stay and decreased survival. Intensive Care Med 1997; 23(Suppl 1): S59.

[24] Kurian S, Mehta A, Shibli MH. Prognostic power of thrombocytopenia in critically ill patients. Chest 2009; 136(4): 28S.

[25] Aluru N, Samavedam S. Thrombocytopenia in intensive care unit. Indian J Crit Care Med 2019; 23(Suppl 3): S185-S8. doi: 10.5005/jp-journals-10071-23249.

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