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Coagulopathy and its Associated Factors among Patients with Bleeding History at the King Faisal Medical Complex in Taif City

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Abstract :

Background : Globally, around 26–45% of the population has a history of gum and nose bleeding, which may result from thrombocytopenia or factors deficiency. Saudi Arabia has a higher incidence of coagulopathy and frequent factor deficiencies.

Methodology : This study was conducted on 119 participants. Patients were recruited from King Faisal Medical Complex-Taif, Saudi Arabia, from February 2023 to April 2023. Blood was collected, and a complete blood count (CBC) test was performed to assess platelet number and prothrombin time (PT)/ international normalized ratio (INR) and activated partial thromboplastin time (APPT) was also done to evaluate coagulation factors. A mixing study was performed for participants with abnormal coagulation profiles.

Result : The study included 65 (55%) males and 54 (45%) females with an average age of 37 ± 19 years from Taif City. 68.1% (81/119) of the total participant had coagulopathy. 61.1% (73/199) had abnormal coagulation profiles, and only 6.7% (8/119) had thrombocytopenia. Individuals with prolonged coagulation time were categorized into three groups: 20.2% had a prolonged PT/INR and normal APTT, 17.6% (21/119) were with abnormal APPT and normal PT/INR and 23.5% (28/119) had abnormal PT/INR and APTT. Of the 73 study participants with prolonged coagulation time, 80.8% (59/73) and 19.2% (14/73) were due to factor deficiency and factors inhibitors, respectively. Multivariable analysis showed that individuals aged 46-65 (AOR = 7.11 (1.20: 41.99) or with a family history of coagulopathy (AOR= 19.45 (2.05: 184.24) were significantly associated with abnormal coagulation parameters.

Conclusion : This study indicated that coagulopathy is more frequent due to factor deficiencies in Saudi Arabia patients with a bleeding history. Also, it showed that chronic disorders are associated with bleeding disorders.

Introduction

Hemostasis is the body's response to vascular damage and includes several events at a site of vascular injury. The maintenance of circulatory hemostasis is achieved by balancing bleeding and clotting. Maintaining blood within a broken blood vessel is crucial for hemostasis. The hemostatic system consists of four components, which are platelets, coagulation factors, fibrinolytic proteins, and vasculature (Dorgalaleh et al.,2018).

There are two types of hemostasis: primary and secondary. Primary hemostasis is the initial response to vascular injury. It is a rapid and short process that involves platelets, circulating fibrinogen, and sticky proteins found in the subendothelial matrix like collagen and von Willebrand factor. Primary hemostasis leads to the creation of a stable platelet plug, which can then serve as the foundation for a fibrin network. Secondary hemostasis is a delayed and long-term response. It involves platelets and the coagulation system. Multiple coagulation factors are sequentially activated during secondary hemostasis, resulting in the development of stable fibrin clots on top of the platelet plug that has been previously formed (Annum Malik et al., 2021).

The impairment of the coagulation compartments causes either hemorrhage or thrombosis. An abnormality in the blood vessel wall or platelet causes a primary hemostasis disease (McMichael, 2005).

Platelet disorders include qualitative and quantitative abnormalities and cause minimal to severe bleeding. Clinically significant bleeding only occurs when there are severe abnormalities in platelet function or severe thrombocytopenia (Arrieta-Blanco et al., 2014). Chances of bleeding are increased when the number of platelets is between 50.000 and 100.000 / mm3. Platelets < 20.000 / mm3 can cause spontaneous bleeding (Arrieta-Blanco et al., 2014).

Thrombocytopenia is caused by hereditary or acquired conditions that contribute to reduced platelet production, increase their destruction, or alter the distribution. However, some cases of thrombocytopenia are idiopathic, such as idiopathic thrombocytopenic purpura, which is the most common form of thrombocytopenia (Pietras & Pearson-Shaver, 2022).

Secondary bleeding diseases are characterized by either qualitative or quantitative abnormality in the procoagulant factors or their inhibitors, such as inhibitors directed against specific factors, anticoagulants, direct thrombin, and non-specific inhibitors (Mokhtar, 2012).

Coagulation disorders are also classified into inherited and acquired disorders. A coagulopathy caused by a deficiency in coagulation factors may cause spontaneous hemorrhages following trauma or surgery. In a few rare instances, acquired coagulopathies brought on by coagulation factor consumption or the existence of autoantibodies to coagulation factors result in a partial or whole neutralization of their function, encouraging their quick removal from circulation. The clinical picture of acquired bleeding disorders usually differs from those of congenital. It includes a broad spectrum of clinical manifestations ranging from minimal or no bleeding to life-threatening events (Menegatti et al., 2019).

Hereditary coagulation disorders involve various conditions, including Hemophilia. There are 400,000 contaminated individuals worldwide with hemophilia. In Saudi Arabia, the number of hemophilic patients ranging between 3000 - 4000 individuals, 99% of whom are men (Ahmad et al., 2008). The most prevalent severe inherited bleeding condition is hemophilia A. It is defined by a deficiency of factor VIII (FVIII), causing insufficient thrombin production and impairment of hemostasis. Hemophilia A is an X-linked recessive disorder that most commonly presents in males during childhood but can also affect females. In 30% of patients, it is caused by de novo mutations in the gene encoding FVIII.

Coagulopathy is a common cause of mortality and morbidity (Tarek Owaidah,2020). Between 26 and 45 % of healthy individuals worldwide have experienced bleeding symptoms that may be caused by thrombocytopenia, factor insufficiency, or pathological inhibitory factors (Aynalem et al.,2021). In Saudi Arabia, a higher incidence of coagulopathy has been reported (AlSaleh et al., 2020). Compared to the Western population, the

Saudi population had frequent coagulation factors deficiencies. Also, it has been reported that bleeding disorders were more often in men than women (38 vs. 26, respectively) (AlSaleh et al., 2020). Therefore, this study will assess coagulopathy among patients with a bleeding history in Taif City and explore its associated factors.

Materials and Methods

Study Design and Population

The current study was performed at the College of Applied Medical Sciences, Taif University, Taif. The study included 119 participants with a history of bleeding symptoms. Samples were taken after receiving approval from the scientific research ethics committee in King Faisal Medical Complex (KFMC), Taif, Saudi Arabia (IBR Registration number with KACST, KSA H-02-T-123; Approval number 2022-A-46). Patients were recruited from King Faisal Hospital in Taif City, Saudi Arabia, from February 2023 to April 2023. The prior consent form was obtained from each participant. Patients who are on anticoagulant therapy or antiplatelet drugs were excluded. Hemolyzed specimens or with an inappropriate ratio of anticoagulant to blood were also excluded.

Data Collection Procedures

Sociodemographic and Clinical Data

Sociodemographic and clinical data were collected using a questionnaire. The questionnaire includes three variables for the Sociodemographic assessment, including gender, age, and marital status, and eight variables for the clinical characterization, including taking medication for chronic disease, using antibiotics, having a family history of bleeding, diabetes, hypertension, cardiovascular disease, respiratory system, and liver disease.

Sample Collection and Laboratory Assays

6 ml of venous blood was collected using a syringe and needle sample collection system. 3 ml was drawn into an EDTA test tube for CBC (Platelet) analysis, and 3 ml was transferred into a sodium citrate anticoagulated test tube for the coagulation profile.

Platelet Count

The platelet count was done by a Sysmex KX-21 hematology analyzer as per manufacturer instructions. Sysmex KX-21 is an in vitro diagnostic automatic multi-parameter (18 parameters) for blood cells count. Thrombocytopenia is defined by platelets number 150.000/mm3 or below.

Coagulation Tests (PT/INR and APTT)

the citrated blood samples were centrifuged at 3000 -3500 rpm for 5 minutes. Platelet-poor plasms (PPP) were separated in Eppendorf tubes.

For prothrombin time,100 µm of control and test plasmas were added to two different test tubes and incubated at 37°c for 3 min, then 200 µm of prewarmed thromboplastin reagent was added into each tube and then mixed well. The time taken from the addition of thromboplastin reagent to the formation of the fibrin clot was measured. The assay was performed in duplicate, and the average was read as PT.

For APTT, the tubes were incubated at 37°c for 3 min, and then 50 µm of control and test plasma were put in 2 different prewarmed tubes. After that, 50 µm of APPT reagent was added to the control and test plasma and re-incubated at 37°c. The Stopwatch was started as soon as the APPT reagent was added. At the end of 3 minutes, 50 µm of prewarmed Cacl was added and mixed with the mixture (plasma and APPT reagent). The time taken from adding APPT reagent to the fibrin clot formation was measured. The assay was duplicated, and the average of the two test readings was indicated as APPT.

Normal Pooled Plasma Preparation

A normal pooled plasma (NPP) was prepared for the mixing study. It is a mixture of the sodium citrate anticoagulated blood plasma received from 30 healthy donors of both genders with normal PT/INR and APPT. The mixture (NPP) is screened for coagulation profiles, and if both PT/INR and APPT were normal, the NPP was stored at – 20 for the mixing study(Kershaw and Orellana, 2013).

Mixing Test

The patient's PPP with an abnormal coagulation profile was diluted 1:1 with NPP and mixed carefully. The mixture was analyzed for the

PT/INR and APTT, as previously explained. The following guidelines were used for the interpretation. A factor deficiency or weak inhibitors were indicated if the addition of NPP to the patient PPP corrected the APTT or PT at the immediate phase; otherwise, a potent inhibitor is indicated. Incubated mixing test was then performed for samples that were corrected at the immediate phase. The mixture was incubated at 37° C for 1–2 hours and then analyzed for coagulation profiles. If the mixture had a normal PT/INR and APPT, A factor deficiency was indicated. If the addition of NPP at the incubation phase did not correct the APTT or PT, weak inhibitors (primarily IgG antibody) were indicated.

Data Analysis Method

SPSS, version 20.0 (SPSS Inc., Chicago, Illinois, USA), was used for statistical analysis. Qualitative data were expressed as frequency and percentage, and quantitative data were expressed as mean± standard deviation (SD) and Chi-square was applied. Logistic regression was used to find out the association between the independent variable with the categorical outcome variable and calculate odds ratio with a 95% confidence interval.

variables with P-value < 0.2 were exported to multivariate logistic regression Significance was indicated if the P value < 0.05.

Results

Sociodemographic and Clinical Characteristics

The current study included 119 study participants; 65(55%) were male, and 54(45%) were female from Taif City. The mean age of the study participants was 37 ± 19 years, ranging from 3 to 65 years. The majority of 68 (57.1%) and 67(56.3%) of the study participants were in the age range of 18–45 years and married, respectively (Table 1). Investigation of the clinical characteristics of the study's participants showed that 37 (31.1%) were taking different medications for chronic disease, 13 (10.9%) used antibiotics regularly, and 12 (10.1%) had with a history of coagulopathy. Additionally, it found that 28 (23.5%) of the total subjects had diabetes, 31 (26.1%) had hypertension, 33 (27.7%) with cardiac disease, 17(14.3%) had respiratory disease, and 9 (7.6%) were with liver disorders.

Table 1. Sociodemographic and clinical characteristics of the study participants

		Total n (%)
Age	< 18	15 (12.6)
	18 - 45	68 (57.1)
	46 - 65	21 (17.6)
	> 65	15 (12.6)
Gender	Male	65 (54.6)
	Female	54 (45.4)
Marital Status	Married	67 (56.3)
	Single	52 (43.7)
Take medication for a chronic disease	Yes	37 (31.1)
	No	82 (68.9)
Use antibiotics regularly	Yes	13 (10.9)
	No	106 (89.1)
History of coagulopathy	Yes	12 (10.1)
	No	107 (89.9)
Diabetes	Yes	28 (23.5)
	No	91 (76.5)
Hypertension	Yes	31 (26.1)
	No	88 (73.9)
Cardiac disease	Yes	33 (27.7)
	No	86 (72.3)
Respiratory disease	Yes	17 (14.3)

	No	102 (85.7)
Liver disorders	Yes	9 (7.6)
	No	110 (92.4)

Laboratory Finding of Coagulopathy Parameters

Coagulopathy parameters, including platelet count, prothrombin time (PT), international normalized ratio (INR), and activated partial thromboplastin time (APTT), were measured. Table 2 shows that 68.1% (81/119) of the total participant had coagulopathy. 61.1% (73/199) were with abnormal coagulation profile and only 6.7% (8/119) had thrombocytopenia. Individual with prolonged coagulation time were categorized into 3 groups: 20.2% had a prolonged PT/INR and normal APTT, 17.6% (21/119) were with abnormal APPT and normal PT/INR and 23.5% (28/119) had abnormal PT/INR and APTT.

Chi-square test showed that patients with thrombocytopenia had a high percentage (25%) of using medication for chronic disease ($P < 0.001$). Prolonged PT/INR was significantly higher in patients aged >45 years (33.3%), ($P = 0.04$). In addition, prolonged APTT was higher in the individual with a history of coagulopathy (41.7%), ($P = 0.02$). On the other hand, participants with abnormal PT/INR and APTT had a high prevalence of taking medication (43.2%) and chronic disorders, including diabetes (42.9%), hypertension (45.2%) and cardiac diseases (48.5%) ($P \leq 0.001$).

Table 2 Characteristics of coagulopathy abnormality in patients' group

		Thrombocytopenia (8/119)		**Prolonged PT/INR**		**Prolonged APTT**		**Prolonged PT/INRAPTT**	
		Yes N (%)	**No N (%)**	**Yes N (%)**	**No N (%)**	**Yes N (%)**	**No (%)**	**Yes N (%)**	**No N (%)**
Age	< 18	2 (13.3)	13 (86.7)	0 (0.0)	15 (100.0)	9 (60.0)	6 40.0)	0 (0.0)	15 (100.0)
	18: 45	5 (7.4)	63 (92.6)	12 (17.6)	56 (82.4)	7 (10.4)	60 (89.6)	11 (16.2)	57 (83.8)
	46: 65	1 (4.8)	20 (95.2)	7 (33.3)*	14 (66.7)	3 (15.0)	17 (85.0)	10 (47.6)	11 (52.4)
	> 65	0 (0.0)	15 (100.0)	5 (33.3)*	10 (66.7)	2 (13.3)	13 (86.7)	7 (46.7)	8 (53.3)
Gender	Male	4 (6.2)	61 (93.8)	12 (18.5)	53 (81.5)	9 (14.3)	54 (85.7)	16 (24.6)	49 (75.4)
	Female	4 (7.4)	50 (92.6)	12 (22.2)	42 (77.8)	12 (22.2)	42 (77.8)	12 (22.2)	42 (77.8)
Marital Status	Married	5 (7.5)	62 (92.5)	14 (20.9)	53 (79.1)	15 (22.7)	51 (77.3)	20 (29.9)	47 (70.1)
	Single	3 (5.8)	49 (94.2)	10 (19.2)	42 (80.8)	6 (11.8)	45 (88.2)	8 (15.4)	44 (84.6)
Take medication for a chronic disease	Yes	3 (25.0) **	9 (75.0)	8 (21.6)	29 (78.4)	7 (19.4)	29 (80.6)	16 (43.2) **	21 (56.8)
	No	5 (4.7)	102 (95.3)	16 (19.5)	66 (80.5)	14 (17.3)	67 (82.7)	12 (14.6)	70 (85.4)
Use antibiotics regularly	Yes	0 (0.0)	13 (100.0)	3 (23.1)	10 (76.9)	2 (16.7)	10 (83.3)	4 (30.8)	9 (69.2)

	No	8 (7.5)	98 (92.5)	21 (19.8)	85 (80.2)	19 (18.1)	86 (81.9)	24 (22.6)	82 (77.4)
History of coagulopathy	Yes	1 (2.7)	36 (97.3)	3 (25.0)	9 (75.0)	5 (41.7)*	7 (58.3)	1 (8.3)	11 (91.7)
	No	7 (8.5)	75 (91.5)	21 (19.6)	86 (80.4)	16 (15.2)	89 (84.8)	27 (25.2)	80 (74.8)
Diabetes	Yes	1 (3.6)	27 (96.4)	7 (25.0)	21 (75.0)	7 (25.0)	21 (75.0)	12 (42.9) **	16 (57.1)
	No	7 (7.7)	84 (92.3)	17 (18.7)	74 (81.3)	14 (15.7)	75 (84.3)	16 (17.6)	75 (82.4)
Hypertension	Yes	1 (3.2)	30 (96.8)	8 (25.8)	23 (74.2)	7 (23.3)	23 (76.7)	14 (45.2) **	17 (54.8)
	No	7 (8.0)	81 (92.0)	16 (18.2)	72 (81.8)	14 (16.1)	73 (83.9)	14 (15.9)	74 (84.1)
Cardiac disease	Yes	1 (3.0)	32 (97.0)	8 (24.2)	25 (75.8)	7 (21.9)	25 (78.1)	16 (48.5) **	17 (51.5)
	No	7 (8.1)	79 (91.9)	16 (18.6)	70 (81.4)	14 (16.5)	71 (83.5)	12 (14.0)	74 (86.0)
Respiratory disease	Yes	1 (5.9)	16 (94.1)	4 (23.5)	13 (76.5)	2 (12.5)	14 (87.5)	7 (41.2)	10 (58.8)
	No	7 (6.9)	95 (93.1)	20 (19.6)	82 (80.4)	19 (18.8)	82 (81.2)	21 (20.6)	81 (79.4)
Liver disorders	Yes	0 (0.0)	9 (100.0)	3 (33.3)	6 (66.7)	1 (11.1)	8 (88.9)	4 (44.4)	5 (55.6)
	No	8 (7.3)	102 (92.7)	21 (19.1)	89 (80.9)	20 (18.5)	88 (81.5)	24 (21.8)	86 (78.2)

- *Indicates statistically significant difference $P < 0.05$
- ** indicates highly significant difference $P \leq 0.001$

Individuals with abnormal coagulation time were investigated further with a mixing study to explore the reasons contributing to coagulopathy, whether factor deficiency or factor inhibitory. Mixing testes (Figure 1) found that, Of the 73 study participants with prolonged coagulation time, 80.8% (59/73) and 19.2% (14/73) were due to factor deficiency and factors inhibitors, respectively. 78.6% (22/28) of patients with prolonged PT and APTT showed a corrected mixing study, while 6(21.4%) of prolonged PT and APTT remind uncorrected. Patients with abnormal APTT showed correction in 66.7% (14/21) whereas 33.3% (7/21) were reminded with prolonged APTT mixing study. On the other hand, most patients with abnormal PT/INR 95.8% (23/124) showed normal PT/INR mixing study, while only 4.2% (1/24) patient had an uncorrected result.

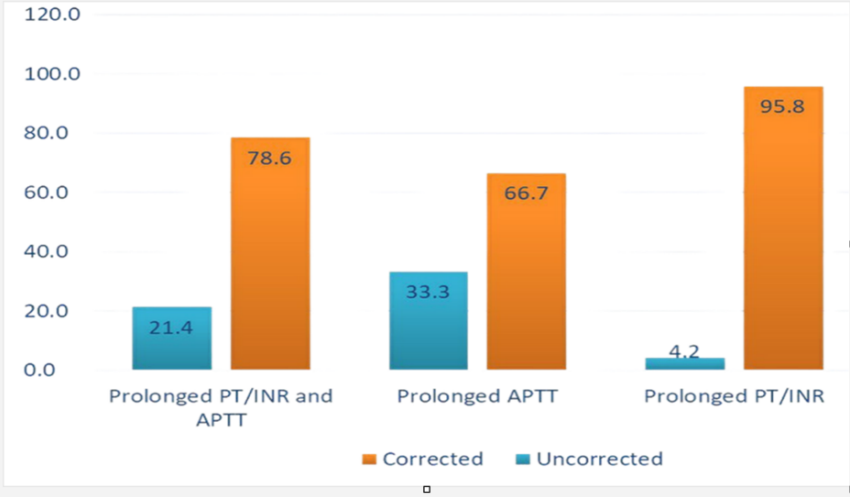

Figure 1. Mixing study results in patients with abnormal coagulation profile

Coagulopathy Associated Factors

Bivariate logistic regression analysis showed that study participants aged 46-65 (COR =8.7; 95% CI: 1.83, 41.78), married (COR = 3.18 (1.47: 6.84), take medication (COR = 2.56 (1.07: 6.09), with history of coagulopathy (COR = 7.98 (0.99: 64.09), or with diabetes (COR = 5.14 (1.65: 16.02), hypertension (COR = 4.53 (1.59: 12.89) and cardiac disease (COR = 5.10 (1.80: 14.46) were associated with coagulopathy. However, in multivariable analysis, only age 46-65 (AOR = 7.11 (1.20: 41.99) and family history of coagulopathy (AOR= 19.45 (2.05: 184.24) were significantly associated with abnormal coagulation parameters (Table 3).

68.1% (81/119) of the total participant had coagulopathy. 61.1% (73/199) were with abnormal coagulation profile, and only 6.7% (8/119) had thrombocytopenia. Individuals with prolonged coagulation time were categorized into 3 groups: 20.2% had a prolonged PT/INR and normal APTT, 17.6% (21/119) were with abnormal APPT and normal PT/INR and 23.5% (28/119) had abnormal PT/INR and APTT. Mixing testes (Figure 1) found that Of the 73 study participants with prolonged coagulation time, 80.8% (59/73) and 19.2% (14/73) were due to factor deficiency and factor inhibitors, respectively. Multivariable analysis only age 46-65 (AOR = 7.11 (1.20: 41.99) and family history of coagulopathy (AOR= 19.45 (2.05: 184.24) were significantly associated with abnormal coagulation parameters

Table 3 Coagulopathy associated factors

				Bivariate logistic regression		**Multivariable logistic regression**	
		Coagulopathy		**COR (95% CI)**	**P Value**	**AOR (95% CI)**	**P Value**
		Yes N (%)	**No N (%)**				
Gender	**Male**	36 (55.4)	29 (44.6)	1	0.15	1	**0.9**
	Female	37 (68.5)	17 (31.5)	1.7 (0.83: 3.73)		1.07 (0.38: 2.97)	
Age	**< 18**	11 (73.3)	4 (26.7)	1	<0.001	1	**0.002**
	18: 45	29 (42.6)	39 (57.4)	2.36 (0.36: 15.46)		1.98 (0.23: 16.83)	

	46 : 65	20 (95.2)	1 (4.8)	8.74 (1.83: 41.78)		7.11 (1.20: 41.99)	
	> 65	13 (86.7)	2 (13.3)	0.33 (0.03: 3.96)		0.22 (0.02: 2.99)	
Marital Status	**Married**	49 (73.1)	18 (26.9)	3.18 (1.47: 6.84)	0.003	1	**0.89**
	Single	24 (46.2)	28 (53.8)	1		1.07 (0.38: 3.07)	
Take medication	**Yes**	28 (75.7)	9 (24.3)	2.56 (1.07: 6.09)	0.03	1	
	No	45 (54.9)	37 (45.1)	1		-	
Use antibiotics regularly	**Yes**	8 (61.5)	5 (38.5)	1	0.99	-	
	No	65 (61.3)	41 (38.7)	0.99 (0.30: 3.24)		-	
Family history of coagulopathy	**Yes**	11 (91.7)	1 (8.3)	7.98 (0.99: 64.09	0.05	19.45 (2.05: 184.24)	**0.01**
	No	62 (57.9)	45 (42.1)	1		1	
Diabetes	**Yes**	24 (85.7)	4 (14.3)	5.14 (1.65: 16.02)	0.005	1	**0.37**
	No	49 (53.8)	42 (46.2)	1		0.26 (0.01: 5.12)	
Hypertension	**Yes**	26 (83.9)	5 (16.1)	4.53 (1.59: 12.89)	0.005	1	
	No	47 (53.4)	41 (46.6)	1		-	
Cardiac disease	**Yes**	28 (84.8)	5 (15.2)	5.10 (1.80: 14.46)	0.002		
	No	45 (52.3)	41 (47.7)	1			
Respiratory disease	**Yes**	12 (70.6)	5 (29.4)	1	0.40	-	
	No	61 (59.8)	41 (40.2)	0.62 (0.20: 1.89)		-	
Liver disorders	**Yes**	7 (77.8)	2 (22.2)	1	0.30	-	
	No	66 (60.0)	44 (40.0)	0.43 (0.09: 2.16)		-	

COR: Crude odds ratio **AOR: Adjusted odds ratio**

Discussion

Coagulopathy is a global health problem that results in mortality and morbidity. Thrombocytopenia, mainly acquired, is the primary cause of bleeding disorders (Jinna and Khandhar, 2021). Hemophilia is the most common heredity coagulopathy disease (Doherty and Kelley, 2019). In Saudi Arabia, a higher incidence of coagulopathy has been reported. This study aims to assess coagulopathy and its

associated factors among patients with a bleeding history in Taif City.

The current study found that the overall incidence of coagulopathy was 68.1%, which is considered a high public health problem. Subjects of this study were recruited from the hospital, which may contribute to the high prevalence shown in this study.

Among individuals with coagulopathy, 61.1% were with abnormal coagulation profile, and only 6.7% had thrombocytopenia.

Thrombocytopenia is commonly associated with bleeding diathesis patients (Jinna and Khandhar, 2021). However, the current study showed a low prevalence of thrombocytopenia in contrast to the published evidence where a high incidence of thrombocytopenia has been reported by a study conducted in Canada (13.3%) (Williamson et al., 2013)well as a study conducted in America (47.6%) (Venkata et al., 2013). However, differences in the study population and in socio-economy may contribute to the variability of the results. On the other hand, it appears that coagulopathy in patients with a bleeding history in this study was mainly caused by an abnormality in coagulation factors, where the majority, (61.1%), showed abnormal coagulation profiles.

Coagulopathy incidence due to factor deficiency and factor inhibitory among abnormal coagulation profiles were 95.8% (59/ 73) and 19.2% (14/73), respectively, based on findings of the mixing study. Also, our study found significant history of coagulopathy in individuals with prolonged APTT ($P = 0.02$). Participants with abnormal PT/INR and APTT were significantly associated with chronic disorders, including diabetes, hypertension, and cardiac diseases ($P \leq 0.001$) and taking medication ($P < 0.01$).

Logistic regression analysis indicated that a family history of coagulopathy was significantly associated with coagulopathy. Study participants with a family history of coagulopathy were nearly nineteen times more likely to develop bleeding disorders than those without a history of the disease. This indicates that factor deficiency is more likely frequent in Saudi people. Consistent with our findings, a recent study reported the high prevalence of coagulation factors deficiency in Saudi Arabia (AlSaleh et al., 2020). More recently, high percentage (73.3%) of hemophilia A has been recorded among the Saudi population (Owaidah et al., 2017) .

Different variables in bivariant analysis were significantly linked to coagulopathy such as, age, marital status, medication, diabetes, hypertension, and cardiac diseases however, the multivariant analysis showed only patients aged 45-65 were significantly associated with bleeding disorders. Advancing age is characterized by an imbalanced hemostatic system that requires medication which in turn predisposes the elderly to bleeding (Kruse-Jarres, 2015). Aging is commonly associated with modification in immune regulation, renal function changing, and a multitude of other disease processes and these may contribute to cause acquired coagulopathy (Kruse-Jarres, 2015)

Moreover, it has been demonstrated that there is an association between coagulopathy and chronic diseases (Nugent et al., 2018). Cardiac disease and diabetes mellitus (DM) are directly accompanied by bleeding disorders (Williamson et al., 2013) (Kabel, 2014). Medication for chronic diseases impacts the normal hemostasis process (Sinan, 2015). Mehta et al., (2016) reported that coagulopathy in a patient with cardiac disease is frequently due to medications that they use. Several drugs contribute to thrombocytopenia and abnormal coagulation profiles, such as heparin, warfarin, glycoprotein IIb/IIIa receptor inhibitors, and thienopyridines (Mehta et al., 2016).

This study has some limitations. Firstly, the sample size is small because of time limitations. Secondly, due to the constraint of resources, other components of hemostasis could not be assessed in this study, such as platelet function, and Von Willebrand factors. Also, we could not perform some advanced techniques that can measure the concentration and activity of coagulation factors and techniques that determine the factor inhibitors.

Conclusion

The present study demonstrated coagulation abnormality among patients with a bleeding history and its associated factors at the King Faisal Medical Complex in Taif City. The primary cause of bleeding disorders was related to abnormal coagulation profiles, while thrombocytopenia was less frequent. Factor deficiencies were more

common in patients with coagulopathy than factor inhibitory. Chronic diseases were also found to associate with coagulopathy among individuals with a bleeding history.

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Declarations

Authors' contributions

Conceptualization, H.M.A. A.M.A., Y.A.A. and E.F.A.; methodology, H.M.A. A.M.A., Y.A.A. and A.S.A; software, E.F.A, A.F.G., F.A., and A.A.A; validation, H.M.A., E.F.A and H.A.A; formal analysis, H.M.A., EF..A., H.A.A and A.S.A; resources, E.F.A, A.F.G., F.A.A. and A.S.A; data curation, A.M.A., Y.A.A. and A.S.A.; writing—original draft preparation, A.M.A., Y.A.A. and H.A.A.; writing—review and editing, H.M.A., A.FG., F.A.A., and M.A; All authors have read and agreed to the published version of the manuscript.

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Availability of data and materials

All data that support study's finding is contained within the manuscript.

Ethical consideration

The study was carried out after receiving approval from the scientific research ethics committee in King Faisal medical complex (KFMC), Taif, Saudi Arabia (IBR Registration number with KACST, KSA H-02-T-123; Approval number 2022-A-46). Moreover, prior consent form was obtained from each participant.

Competing interests

The authors declare that there is no conflict of interest regarding the manuscript publication.

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