Original Article

Role of bleeding time and clotting time in preoperative hemostasis evaluation

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ABSTRACT

A six months retrospective study was done to find out the utility of bleeding time (BT) and clotting time (CT) in evaluation of preoperative hemostasis. All the BT and CT requested for preoperative evaluation were analysed with other parameters determining the normal hemostasis. The sensitivity of bleeding time was only 20% and for clotting time was 11.1%. This study highlights the drawbacks of this commonly misused hematology tests and discusses the other more scientific alternatives during preanaesthetic workup of a patient.

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Key Words: bleeding time, clotting time, preoperative evaluation

Introduction

Preoperative hemostasis evaluation has always been a significant factor in the minds of surgeons and anaesthetists before taking any case for surgery. Since its initial invention by the French worker Milian in 1901, the bleeding time has been put forward as a clinically useful test in three contexts: diagnosis (particularly of platelet disorders), prediction of clinically important bleeding, and assessment of the adequacy of various forms of therapy. Whole blood clotting time has been used in past to assess both the intrinsic and extrinsic pathways of coagulation. Both these tests have gone to disrepute because of inherent fallacies in the tests. The BT and CT are still being requisitioned as a routine preoperative test in many service hospitals. These two tests even if reported normal do not exclude bleeding diathesis as the results of both the tests are only altered after a significant fall of platelet or clotting factors as the case may be. The preoperative workup of a patient to rule out bleeding diathesis can be done by taking a careful history and a battery of more reliable tests.

Material and Methods

A six months retrospective study was carried out at a large service hospital. All BT and CT requested for preoperative hemostasis evaluation were analysed. The BT was carried out by the Duke's method wherein a standard deep cut was made on the finger pulp with a lancet of 3mm depth, the first drop of blood was wiped out subsequently the blood was blotted on a filter paper every 30 sec until the blood stopped oozing. The normal BT by this method is 1-5 minutes [1]. The whole blood clotting time was carried out by modified Dale's method wherein the similar prick is made into the finger pulp and blood is taken into a standard glass capillary tube by the capillary action. Subsequent to this the end of capillary tube is broken every 30 sec until the clot is formed and the end of capillary tube starts hanging. The normal clotting time by this method is 5-11 minutes [1]. The platelet count was done by an automated hematology autoanalyser. The PT and aPTT were performed as per standard

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protocols [2]. The platelet count, prothrombin time (PT) and activated partial thromboplastin time (aPTT) if done in these patients were correlated with the readings of BT and CT. A BT of >5min; CT>11min; Platelet <1 lac/cmm and PT/ aPTT of >4 sec than control were considered abnormal. The institutional control of PT was 14 sec and aPTT was 30 sec respectively.

Results

A total of 912 BT & CT were carried out during the study period for preoperative evaluation. Out of these only three cases had high bleeding time and five had prolonged clotting time. The total number of patients who underwent a simultaneous platelet count, PT and aPTT is tabulated in Table 1.

Table 1: Number of patients who underwent Platelet count, PT & aPTT

Total No. (n= 912)	Platelet Count	PT	aPTT
No. Of Patients	96	188	44

The patients having low platelets, deranged PT & aPTT are tabulated in Table-2.

Table 2: Number of patients having low platelet count, deranged PT & aPTT

Total No. (n= 912)	Low Platelet Count	Deranged PT	Deranged aPTT
No. Of Patients	10	36	20
Percentage(%)	10	19	40

The total of 366 patients out of the study group (n= 912) required more than 2 points of whole blood transfusion/ fresh frozen plasma due to non surgical bleeding.

The correlation of BT with platelet count and that of CT with PT and aPTT has been tabulated in Table 3,4,5&6.

Table 3: Correlation of low platelet count with BT and deranged PT/aPTT with CT

Total No. (n= 912)	Low Platelet Count	Deranged PT	Deranged aPTT
No. Of Patients	10	36	20
Deranged BT	2	-	-
Prolonged CT	-	4	4
False Negative	8	32	16

Table 4: Statistical analysis (Plt Count Vs BT) was done using chi square test.

	Platelet < 1 lac/cmm	Platelet > 1 lac/cmm	Total
Deranged BT	2	1	3
Normal BT	8	85	93
Total	10	86	96

Table 5: Statistical analysis (PT Vs CT) was done using chi square test.

	Deranged PT	Normal PT	Total
Deranged CT	4	1	5
Normal CT	32	151	183
Total	36	152	188

Table 6: Statistical analysis (aT Vs CT) was done using chi square test.

	Deranged aPTT	Normal aPTT	Total
Deranged CT	3	1	4
Normal CT	16	23	39
Total	19	24	43

On applying chi square test for BT Vs platelet count following values for BT have been derived. False positive = 1, False negative = 8, Sensitivity = 0.2 (20%), Specificity = 0.988 (98.8%), Positive predictive value = 0.667 (66.7%) Negative predictive value = 0.913 (91.3%), True positives = 2, True Negatives = 85.

The correlation of CT with PT and aPTT has been tabulated in Table 3,5&6. On applying chi square test for CT Vs PT following values for

CT have been derived. False positive = 1, False negative = 32, Sensitivity = 11.1%, Specificity = 99.3%, Positive predictive value = 80% Negative predictive value 82.5%, True positives = 4, True Negatives = 151. On applying chi square test for CT Vs aPTT following values were derived. False positive = 1, False negative = 16, Sensitivity = 20%, Specificity = 95.8%, Positive predictive value = 80% Negative predictive value = 58.9%, True positives = 4, True Negatives = 23.

Discussion

The value of obtaining screening tests before surgery have been an issue of debate for years. The hemostasis in body is fulfilled by adequate functions of the vessel wall, adequate number/ function of platelets and an intact coagulation cascade. Vascular abnormalities like hemorrhagic telengectasia, hereditary connective tissue disorder, autoimmune, allergic and drug induced purpuras can be ruled out during a preanaesthetic check up by careful examination. Bleeding diathesis in relation to platelets can be due to thrombocytopenia (decreased production by marrow, increased peripheral destruction) or due to platelet dysfunction. The coagulation factor deficiency of various grades can lead to different types of bleeding disorders.

The hemostasis has been divided into vascular/ platelet phase and the coagulation phase. The tests available for the first phase are bleeding time, platelet count and platelet function assay [3]. The tests available to test the coagulation phase of hemostasis are whole blood clotting time, plasma fibrinogen, prothrombin time, activated plasma thromboplastin time, thrombin time, d-dimers and inhibitors of coagulation. The conventional Dale's method of capillary tube clotting time has a significant drawback of getting deranged only when there is a drop in coagulation factor of more than 40% of normal values. The test is not sensitive, is nor carried out at 37°C (normal human temperature) and does not have a clear cut end point. The test is commonly misinterpreted because only the initial traces of thrombin formed is enough to cause the clotting in the outermost part of column of blood within the capillary tube [1]. The PT and aPTT comparatively are more sensitive in the sense of being deranged on dip of as less as 15% of concerned coagulation factors. It is carried out at 37°C and assesses the intrinsic and extrinsic pathway.

The bleeding time has been practiced for several decades in the way described in1910 by Duke. Subsequent important modifications attempted at standardizing the procedure were introduced by Ivy et aI and Mielke et a1. Practically unquestioned as to its clinical usefulness until the mid-l980s, despite the lack of appropriately controlled studies addressing the issue of its predictive ability with regard to the risk of actual bleeding, the validity of the bleeding time as a useful clinical test has been seriously questioned by a number of investigators [4]. Under discussion is not so much the value of the test as an epidemiologic or pharmacologic tool to explore primary hemostasis, but rather its practical usefulness in predicting negative history of bleeding in situations in which the haemostatic system is seriously challenged, such as during major surgery. De Caterina performed linear regression analysis to assess specificity, sensitivity, and positive and negative predictive values of BT. There was relatively low correlation coefficients between the bleeding time and some of the alternative parameters and there was no significant relationship between any value derived from the bleeding time test and any index of actual bleeding [5].

The first drawback of this test is that it does not discriminate between the platelet defect and vascular defect. The old concept was that the bleeding time is altered by platelets and vessel wall

parameters. However of late there are various studies that have concluded that the BT is also altered by hematocrit, skin quality and the technique [6,7,8]. The inter and intraobserver variation amongst the technicians is as high as 20% [4]. No two skin areas of the body are exactly the same and do not give similar results [9]. There is no absolute correlation of skin bleeding time and the extent of bleeding in the viscera during an operation [4]. It has been hypothesized that the main reason for the lack of a relationship between the cutaneous bleeding time and surgical bleeding lies in the multiple determinants of surgical bleeding, which might obscure, by their preponderant weight, the possible predictive capacity of the bleeding time test. Linear regression analysis was applied to data from 23 studies relating platelet count to bleeding time, to assess published claims that the bleeding time and platelet count follow a predictively useful linear relationship. In 22 of 23 instances, the inverse relationship between bleeding time and platelet count was associated with broad statistical scatter, making it impossible to predict precisely one variable given the other [5]. The pathophysiology of an abnormal bleeding time remains poorly understood. The bleeding time is affected by a large number of diseases, drugs, physiologic factors, test conditions, and therapeutic actions, not all of them platelet-related [5]. There have been studies showing no statistical correlation between the preoperative BT and the amount of surgical loss or the requirements of the blood products [10,11].

In our study out of the entire study population of 912 only 94 had undergone a platelet count. 10 of these patients had thrombocytopenia (<1 lac/cmm). Only 2 of these patients showing a deranged BT. Out of the 36 patients who had a deranged prothrombin time only 4 patients had a prolonged clotting time. BT apart from platelet count is also a marker for platelet function and the vascular reasons of bleeding diathesis but a sensitivity of BT as 20% vis-a-vis the platelet count clearly proves its inefficiency as a screening test for preoperative hemostasis. Platelet function is assayed better by aggregrometry when the index of suspicion is high. Vascualr phase defects can be ruled out by a good history and a careful examination. CT had a sensitivity of only 11.1% vis-a vis PT, that clearly signifies the fallacies of this test as a screening test. In the study population 36 patients required > 3 blood bags/fresh frozen plasma. This set of patients excludes the bleeding due to surgical causes of bleeding. Only 4 out of these 36 patients had a deranged CT and BT in preoperative evaluation. At the same time 11 of these cases had undergone platelet count, PT or aPTT. 10 of these 11 cases had one of these values deranged again proving the superiority of these tests over BT and CT. Further there was a loss of 3manhours per day to the hospital laboratory carrying out the BT & CT.

General approach to preoperative hemostasis evaluation includes careful history taking and first line screening tests. A history of a molar extraction with brisk bleeding of less than 1 hour and oozing less than 2 days signifies an intact haemostatic system [12]. A history of trauma with normal clotting, normal delivery and menstruation are also important indirect markers of intact coagulation and vascular phase of hemostasis. The acquired bleeding disorders like disseminated intravascular coagulation, leukaemia, drugs and purpuras (allergic, drug induced) can easily be ruled out by proper examination and baseline investigations. The coagulation and platelet defects can be easily differentiated by simple history and examination as shown in Table 7.

The laid down guidelines [13] for preoperative hemostasis is appended in Table 8.

Table 7: Clinical distinction between Vascular/platelet disorder and coagulation disorder

Finding	Coagulation Disorder	Vascular/Platelet Disorder
Petechiae	Rare	Characteristic
Deep Dissecting Haematoma	Characteristic	Rare
Superficial ecchymosis	Common	Characteristic
Haemarthrosis	Characteristic	Rare
Delayed Bleeding	Common	Rare
Bleeding Superficial Cuts	Minimal	Persistent
Sex	Male	Female
Positive Family History	Common	Rare except vWD

Table 8 : Guidelines for preoperative hemostasis evaluation

Level	Procedure	Bleeding History	Evaluation
I	Minor	Negative	None
II	Major	Negative	Platelet Count, aPTT
III	Major involving hemostatic impairement	Equivocal	Level II + PT, Factor XIII analysis, clot lysis time
IV	Minor/Major	Positive	Level III +, Factor VIII, IX, XI, Platelet aggregration test & Fibrinolytic tests

Certain disorders will even be missed by the battery of first line screening tests (PT, aPTT, platelet count) which includes: von Willerbrand disease, mild inherited coagulation disorders, factor XIII deficiency, dysfibrinogenemia, disorders of platelet function and allergic/vascular purpuras. A simple questionare can be developed by anaesthetist during PA check up to exclude history of bleeding diathesis in past [14,15].

Conclusion

The screening tests for hemostasis are not fully satisfactory to rule out mild forms of bleeding diathesis. Careful history taking and examination can rule out these disorders especially when minor surgery is planned. However screening tests are of value in high risk patients like patients of liver disease, biliary obstruction, renal disease, myelofibrosis and other myeloproliferative disorders. The bleeding time test is likely to remain widely used for the diagnosis of inherited disorders of platelet function, such as von Willebrand's syndrome. However, its application in preoperative analysis is highly questionable due its low sensitivity. The whole blood clotting time also has a very low sensitivity and negative predictive value. We recommend the discontinuation of BT and CT as a routine preanaesthetic checkup for hemostasis evaluation and should be replaced by the standard guidelines mentioned above.

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