Introduction

Heparin is the most commonly used anticoagulant in the clinical practice over more than 7 decades. It is one of the most frequently used Parenterally administered medication in the hospitalized patients [1]. Heparin is a strong negatively charged polyanion with a molecular weight of 3000 to 30,000 Daltons.

Heparin induced thrombocytopenia (HIT) is a known but rare complication of heparin therapy. It is a potentially life and limb threatening, prothrombotic coagulation disorder associated with significant increased in the morbidity and mortality. Early and accurate diagnosis or exclusion of HIT is the cornerstone in the management of these patients; as the over diagnosis will result in use of alternative anticoagulant with increased bleeding risk or under diagnosis or delayed diagnosis will leave patient vulnerable for the development of thrombosis.

Case

A 19-year-old male driver involved in road traffic accident had isolated fracture shaft of femur. No any history of loss of consciousness, initial computerized tomography (CT) of head, chest and abdomen was normal. Immediately fracture was fixed with intramedullary nail. Perioperative period was uneventful. After 10 hours of surgery, family noticed that he had incoherent speech, and tachypnea; immediate examination revealed that he is drowsy, tachypnea (40-50/minute) tachycardia (130-150/minute) oxygen saturation of 60%; bilateral ricketsations. Chest x-ray showed bilateral diffused infiltrates. Diagnosed as fat embolism syndrome; intubated added LMWH to the treatment and shifted to the intensive care unit. CT chest and brain revealed bilateral alveolar opacities and early brain edema respectively. He was in acute respiratory distress syndrome, remained on inverse ratio mechanical ventilation and had thrombocytopenia (70,000), HIT antibody test was requested; by day 3 he was improving clinically his chest condition was much better, but surprisingly HIT antibodies test came as positive. Functional assay lateral flow immunoassay test (LFIA) was not available. We reviewed patient's clinical probability of HIT by 4 ‘T’ score; he had a low probability of HIT. HIT was excluded, LMWH was continued. Gradually he improved; weaned and extubated by day 8, transferred to the ward on day 10 from there discharged home.

Definition

Thrombocytopenia is common in the hospitalized patients. Heparin induced thrombocytopenia (HIT) can be defined as clinicopathological procoagulant condition with thrombocytopenia in patients on heparin therapy. Platelet count of less than 100,000 or decrease by 50% of the baseline value from 5-14 days of heparin therapy. In rare case HIT can occur before 5th day or after the 14th day or even after stopping the heparin therapy.

Epidemiology

HIT is underdiagnosed and underreported, the reported incidence of HIT is ranging from 1 to 5% of the patients on unfractionated heparin and thrombocytopenia [4]. But up to 8% of the patients on heparin therapy develop HIT antibodies and the incidence of HIT varies with type and duration of heparin use; HIT is 10 times more common with unfractionated heparin in comparison to the LMWH. It is more common in female patients. The incidence of HIT is higher in surgical than the medical patients, incidence are higher in cardiovascular and orthopedic patients, it is lower in obstetric patients [5].

Risk factors

The use of unfractionated heparin increases the risk of HIT, large
intravenous unfractionated heparin dose, bovine heparin, surgical and female patients [6].

Classification

HIT is divided into two types depending on whether immunologically mediated or not; Type 1 also called as heparin associated thrombocytopenia and not caused by the development of antibodies but related to the large heparin dose. It occurs with first few day of heparin therapy and not associated with thromboembolism. Type 1 HIT is a self limiting condition [7]. (Table1) As heparin is a strongly negatively charged anion, binds with the positively charged platelet leading to thrombocytopenia. It occurs in first three days of heparin therapy and decrease in platelet count is not more than 30% of the baseline value [8]. Type 2 HIT is an immunologically mediated thrombocytopenia caused by the heparin dependent antibodies, it is further subdivided into (i) heparin antibodies development without any thrombocytopenia (ii) development of thrombocytopenia and heparin antibodies. (iii) HIT thromboembolic syndrome or HIT with white clot thrombosis, as there is lack of red blood cells in the clot and thrombosis occurs due to the complex formation of platelets and immunoglobin [9].

Type 2 HIT commonly occurs from 5 to 14 days of heparin therapy, it can occur earlier if patient had an exposure to heparin in last 3 months. Delayed HIT occurs even after heparin is stopped, as the B-cell which needs at least 5 days for sufficient antibodies production. Type2 HIT is potentially limb and life threatening condition requiring early diagnosis and an earlier alternative anti-coagulation therapy (Table 1).

Pathophysiology

The pathophysiology of type 1 HIT is simple, as negatively charged heparin on initiation of the therapy binds to positively charged platelets leading to mild thrombocytopenia. Whereas the pathophysiology of type 2 HIT is a complex immunologically mediated process; resulting in severe thrombocytopenia as well as generation large quantity of thrombin and leading to thromboembolism.

In type 2 HIT, heparin will bind with platelet factor 4 (PF4) and forms an immunological antigen, which stimulates generation of antibodies. This heparin+PF4 and IgG complex, will bind to the FC receptor site on platelets. (Figure 1) These process results in platelet activation. Heparin interaction with PF4 depends on molecular weight of heparin, longer and more sulfated unfractionated heparin chains are more immunological, hence wrap more PF4 particles compared to the LMWH; hence more risk for development of HIT.

HIT pathophysiology can be summarized in three steps; the initial step is generation of antibodies, second step is platelet activation and thrombin generation (this stage is potentially procoagulant) and stage is thrombus formation. Hypercoagulant /procoagulant condition in HIT is multifactorial, loss anticoagulation effect of heparin, platelet activation, microparticle in the circulation, increased thrombin generation and activation of intrinsic factors [10].

Diagnosis

Diagnosing HIT is a challenge, as the suffering patients will often have other reasons for thrombocytopenia. HIT is a clinicopathological condition, hence it is diagnosed by clinical probability (4’T’ score) and presence of HIT antibodies. Clinical probability of HIT in a susceptible patient can be evaluated by 4 ‘T’ score. (Table 2) This score is depending on severity and timing of thrombocytopenia in relation to heparin therapy, presence or absent of the thrombus and other etiological reasons for thrombocytopenia. If this score is less than 3, there will be low probability for HIT and if it is above 6, there will be high probability for HIT and score of 4-5 will show intermediate probability for HIT [11]. If clinical probability with 4’T’ score is low, it will rule-out HIT [11].

| AT’s                   | 2 points | 1 point | 0 point |
|------------------------|----------|---------|---------|
| Thrombocytopenia       | Platelet count fall >50% and platelet nadir ≥20* | Platelet count fall 30–50% or platelet nadir 10–19 | Platelet count fall <30% or platelet nadir <10 |
| Timing of platelet count fall | Clear onset between days 5–10 or platelet fall ≤1 day (prior heparin exposure within 30 days) | Consistent with days 5–10 fall, but not clear (e.g. missing platelet counts); onset after day 10; or fall ≤1 day (prior heparin exposure 30–100 days ago) | Platelet count fall <4 days without recent exposure |
| Thrombosis or other sequelae | New thrombosis (confirmed); skin necrosis; acute systemic reaction postintravenous unfractionated heparin (UFH) bolus | Progressive or recurrent thrombosis; Non-necrotizing (erythematous) skin lesions; Suspected thrombosis (not proven) | None |
| Other causes for thrombocytopenia | None apparent | Possible | Definite |
| Low probability: 0-3 | Moderate probability: 4-5 | High probability: 6-8 |

Table 1: Pretest scoring system for HIT: the 4 T’s.

Figure 1: Immunology of HIT.
hemorrhage. It can be differentiated from HIT by bleeding, abnormally prolonged activated prothrombin time with thrombocytopenia [15].

Hyper responsive thrombocytopenia occurs in various inflammatory diseases, such as eczema, allergic rhinitis, and bronchial asthma. Particularly, the platelets are actively involved and consumed in acute bronchial asthma leading to bronchial hyper responsiveness, bronchoconstriction with airway inflammation, and thrombocytopenia. It can be differentiated from HIT by the signs and symptoms of primary etiology leading to hyperactive response [16].

Management

The management of HIT can be summarized by six ‘a’s [7].

1. Avoid and stop all heparin (any form, any route, heparin flush or heparinised catheters).
2. As early as possible start direct thrombin inhibitors.
3. Anti PF4 / heparin antibody test for confirmation of diagnosis.
4. Avoid platelet transfusion.
5. Await platelet recovery.
6. Assess thrombosis of lower extremities.

The highest risk period for the development of thrombosis is from the diagnosis of HIT to the starting of anti-thrombin agents. The use of direct thrombin inhibitors (DTI) is a corner stone in HIT therapy as it rapidly stops the thrombus storm. Commonly used DTI are Argatroban and Lepirudin. Argatroban is an L-arginine based molecule. It is shorter and reversible in binding with thrombin. Lepirudin is a desulfated recombinant hirudin-like protein. It is eliminated through the renal system and needs adjustment of the dose in renal failure patients. There is no antidote for both DTI and it is necessary to adjust the dose to avoid coagulation disorders [17]. The warfarin therapy needed in HIT patients should be delayed until the platelet count is >100x10^3/µl and DTI must be continued for at least five days in conjunction with warfarin therapy.

Prevention

To some extent HIT can be prevented by using heparin therapy for only short periods and starting warfarin early if there appears to be a need for prolonged anticoagulation; avoiding bovine and fractional heparin and using lower molecular weight heparin [5]. Avoiding heparin flush for central and arterial catheters, avoiding heparin lock, using heparin-free dialysis will decrease the incidence of HIT as well as coagulation disorders [18].

Morbidity and Mortality

Mortality in HIT patient is ranging from 20-30%. HIT without thrombosis has mortality up to 21%. In HIT patients treated with DTI the mortality decreases to 16% and the incidence of new thrombus decreases to 5.8% [19].

Conclusion

HIT is a distinct clinico-pathological syndrome, potentially limb and life threatening condition. It has a unique pathophysiology and testing. Low probability 4'T' score or LFIA will rule-out HIT in 10 minutes. It has a unique complication profile: Thromboemboli. HIT requires a unique management with the alternative anticoagulants; it is a unique thrombocytopenia, where the risk of thrombosis is more than that of bleeding. Ruling out of HIT antibodies is an important step in selecting most appropriate therapy.
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