Diabetes and the blood – white cells and platelets

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People with diabetes often have haematological abnormalities. These include anaemia and other red cell problems. White blood cell and platelet abnormalities are also common among people with diabetes. Haematological issues can have a major impact on patients and should be actively sought and treated.

**White blood cells (WBCs, leucocytes)**

**Onset of diabetes**

Peripheral neutropenia may occur before and during the onset of type 1 diabetes (not type 2). A study found that peripheral cell death, impaired differentiation, and anti-neutrophil antibodies did not appear to cause neutrophil reduction. Neutrophils were found at microvascular level in patients' exocrine pancreas (at onset and later).

Adults with newly diagnosed type 1 diabetes had lower total white cell blood count (WBCC), and fewer neutrophils, basophils, monocytes and lymphocytes than controls, but similar erythrocyte, eosinophil and platelet counts. This supports 'a general involvement of the innate immune system in the pathogenesis of type 1 diabetes'.

A study among Pima Indians found that a high WBCC predicted 'a worsening of insulin action and the development of type 2 diabetes'. Among Indian Asian patients, neutrophil–lymphocyte ratio (NLR) in those with type 2 diabetes exceeded that of people with impaired glucose tolerance, which exceeded levels in normal controls. NLR correlated with glycated haemoglobin, fasting glucose and insulin resistance as assessed by homeostasis model assessment (HOMA-IR). However, a recent meta-analysis of studies of WBCC and type 2 diabetes found that, although raised WBCC is associated with higher risk of type 2 diabetes, 'the presence of publication bias and failure to control for all potential confounders in all studies means the observed association is likely an overestimate'.

**Neutrophils: infection**

Some infections are more likely among people with diabetes than in those without. Compared with non-diabetic people, those with diabetes often have more severe infections which require more vigorous and prolonged antibiotic and surgical or other treatment. For example, a Dutch study of patients with type 1 and type 2 diabetes found an increased risk of infections of the lower respiratory tract, the urinary tract, and skin and mucous membrane.

Impaired neutrophil function contributes to increased infection risk and severity. Animal and human studies have shown impaired chemotaxis, phagocytosis, and microbicidal activity. So diabetic patients' neutrophils, their main defence against bacterial and some other infections, don’t get to the infection as fast as they should, and once there, don’t do their job properly. They also die sooner than normal.

**Glucose control and infection**

Postoperatively, poorer glycaemic control has been linked to a greater risk of infection. Among elective surgical diabetic patients not previously infected, 31% with glucose >12mmol/L on day one postoperatively (POD1) developed an infection versus 11% with glucose ≤12mmol/L. Patients with one glucose >12mmol/L on POD1 were 5.7 times more likely to develop serious infection. Each millimole glucose rise >6.1mmol/L on POD1 increased the risk of complications by 17% after coronary artery bypass grafting.

Good postoperative glucose control may reduce the risk of hospital-acquired infection. In a German hospital, a pilot perioperative glucose control regimen produced glucose levels at surgery of 8.33±3.99mmol/L versus 9.56±2.94mmol/L in controls, and more glucose levels within target range in hospital. Hypoglycaemia rates were similar in both groups. There were fewer hospital-acquired infections in the intervention group than in the control group (RR 0.20, 0.06–0.72). Improving glucose control, e.g. with insulin infusion therapy during cardiac surgery, improves neutrophil function.

**White cell scans**

WBC scanning, or isotopic labelling of leucocytes, is used in people with diabetes to seek hidden infection, e.g. in diabetic foot disease if magnetic resonance imaging is contraindicated.

**Diabetic ketoacidosis**

Diabetic ketoacidosis (DKA) is often precipitated by infection. But WBCC is often raised in DKA without infection. Chinese DKA patients had elevated WBCC (predominantly neutrophilia), while those with nonacidotic ketosis had slightly raised WBCC (within the normal range). Both exceeded WBCC of non-ketotic patients. WBCC elevation was greater in patients with acute infection. Eosinophils were lower in the DKA group. On treatment neutrophilia fell and eosinophils rose. Patients included both those with type 1 diabetes, and ketosis-prone type 2 patients which complicates the results.

**Complications**

Patients with diabetic complications may have higher WBCC than those without. For example, Korean patients with diabetic retinopathy had higher neutrophil counts than those without, and those with more severe retinopathy had higher WBCC.

**Platelets**

People with diabetes have multiple abnormalities of platelet function usually causing hyper-reactivity with greater adhesiveness, activation, and aggregation than people without diabetes. These platelet abnormalities are associated with increased clotting, impaired clot breakdown, endothelial dysfunction, and platelet hyper-reactivity. This contributes to the increased risk of atherothrombotic events in people with diabetes compared with non-diabetic individuals.
Glucose control and platelet activation
Acute hyperglycaemia is associated with increased platelet activation, shown by increased surface adhesion molecules such as P-selectin.\(^{18}\) HbA1c and fasting glucose correlated with P-selectin levels in type 2 diabetic patients.\(^{19}\) Patients with type 2 diabetes were studied before and three months after improving metabolic control. Initially they had more activated platelets than controls. Platelet activation reduced after improving metabolic control.\(^{20}\)

Antiplatelet therapy
Aspirin is not recommended for primary prevention of cardiovascular disease in diabetic people.\(^{21}\) Patients with diabetes who have proven cardiovascular disease or thromboembolic events should receive standard antiplatelet or anticoagulant therapy unless this is contraindicated.

Thrombocytopenia
Thrombocytopenic patients may have increased bruising or bleeding with insulin injections and finger-prick blood glucose testing. Use minimal blood sample volume techniques for finger-prick blood glucose testing.\(^{22}\) Insulin pump treatment and continuous glucose monitoring may help (although bruising and bleeding may still occur). Diabetes is often associated with conditions in which platelet abnormalities occur; for instance, thrombocytopenia may be found in liver disease, hepatitis C, HIV, recurrent transfusion e.g. in thalassaemia, severe vitamin B12 deficiency (which may also lower WBC).

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References

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