

Massive haemorrhagic blister formation following total knee arthroplasty

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Lesson

Skin blistering following trauma is not uncommon; however, large haemorrhagic bullous blisters following total knee arthroplasty is relatively rare and not widely documented in the literature.

Keywords

Clinical, dermatology, orthopaedic and trauma surgery, surgery

Introduction

Skin blisters are fluid filled sacs that arise in the dermal–epidermal junction as an aftermath of increased shear forces at this juncture. These can be secondary to trauma, compartment syndrome severe infection, vascular insufficiency and autoimmune conditions. We present a rare case of a patient developing severe haemorrhagic blisters as a direct consequence of undergoing a routine total knee replacement for osteoarthritis.

Case report

A 72-year-old gentleman presented with end stage osteoarthritic symptoms affecting his right knee and had failed conservative management. He had a medical history of obstructive sleep apnoea, ulcerative colitis and ischaemic *heart* disease. He had no known allergies. He underwent a routine right total knee replacement (NexGen LPS Flex, Zimmer Inc., Warsaw). This is the standard default implant used by the senior surgeon. It is a cemented, cruciate sacrificing implant. The senior surgeon routinely does not resurface the patella as part of the procedure. The procedure was performed under a spinal anaesthetic. As per routine, a high thigh tourniquet was applied (inflated following draping to a pressure of 300 mmHg). The skin was prepped with alcoholic Chlorhexidine and draped as per standard.

The procedure was carried out by the senior surgeon as per routine.

The enhanced recovery protocol was followed which included the infiltration of 150 ml Ropivocaine with Adrenaline 1:1000 (1 mg/2 ml) into the surgical site including the deep posterior capsule and peri-articular tissue. As is routine practice in our institution, no surgical drain was utilised and prior to tourniquet release, an Opsite dressing (Smith & Nephew) was applied to the wound with the knee in 90° flexion. The leg was also bandaged with cotton wool and crepe bandage.

The patient, 2 h post-operatively, developed large haemorrhagic blisters throughout the operated limb starting at the level of the thigh. This was monitored on the ward and his leg was elevated. He was given venous thrombo-embolic prophylaxis with Enoxaparin 40 mg subcutaneously once daily at night.

The patient was improving his range of movement to 0–80° by day 3 post-operative, with the aid of the physiotherapists. However, he was developing an increasing number of blisters of increasing size in his operated side lower limb which was giving rise to concern. He was started on prophylactic intravenous antibiotics as these blisters were de-roofing. He had an inpatient stay of 14 days to keep a close supervision of the wound and blistering.

This patient was followed up in the outpatient clinic. The blistering did eventually settle at four weeks and without a resulting deep infection. The patient was followed up in the outpatient clinic regularly till 12 months post-operatively where he was discharged from clinic with Oxford Knee Scores comparable to other satisfied patients following knee arthroplasty.

Figure 1 shows a clinical photograph of the pro-found blistering at day 10 and Figure 2 shows the same at 6 months.

Figure 1. Appearance of the right knee at 10 days post-operation.



Figure 2. Appearance of the right knee at six months post-operation.



Discussion

Shelton in 1986 defined skin blisters as bullae representing areas of epidermal necrosis with separation of the stratified squamous cell layer from the underlying vascular dermal layer by tissue oedema fluid. Total knee arthroplasty is a common procedure in the UK, with patients having a lifetime risk of requiring total knee arthroplasty up to 10%.^{1,2} Skin blistering following trauma has been quoted as occurring in as high as 35% of patients and the causes can be multifactorial, including the use of dressings and tourniquets.³⁻⁵ However, the incidence of significant blistering associated with arthroplasty remains rare. Blistering can be more simply defined as a fluid-filled sac under the epidermis. Skin blistering is the result of the epidermis separating from the underlying dermis following frictional forces across the skin. Formation of these blisters results in the protective barrier of the skin breaking down and increases the risk of developing a periprosthetic joint infection.⁶ While intact blisters are sterile in nature, they can get contaminated after rupture and multiple studies have shown the link to this and the increased risk of periprosthetic joint infections.^{7,8}

The aetiopathology of these blisters appear to result from excessive stress at the level of the skin from increased pressure at the dermo-epidermal junction. Histologically, blistering occurs due to the separation of the epidermis (stratified squamous epithelium) from the vascular dermis with the simultaneous build-up of oedema fluid in between.⁵ This results in areas of necrosis to the devitalised epidermis. Blisters can be classified into two main categories, namely haemorrhagic and clear. It is recognised that haemorrhagic blisters represent a more significant soft tissue injury and take longer to re-epithelialise.⁹ Clear blisters are as a result of cleavage within the epidermis itself whereas the haemorrhagic blister represents a cleavage of the epidermis from the dermis. The papillary dermis insult leads to bleeding into the cavity with the resulting haemorrhagic blister.

The causes of blistering in patients following arthroplasty is likely to be multifactorial and can be

divided into patient factors and surgical factors. The patient factors could include obesity, increasing age, vascular, autoimmune conditions and any disease that predisposes to poor wound healing including smoking, alcohol, diabetes and hypertension. The surgical factors could include increasing tourniquet time, surgical dressings and skin preparations.

With increasing age, there is loss of elastin and collagen leading to a degradation in the framework of skin, therefore predisposing to increased risk of blister formation. Obesity is linked to venous insufficiency and increased interstitial pressures.¹⁰

There have been multiple studies illustrating that wound dressings are related to the blistering rate.^{11,12} Further, factors affect the formation rate of blisters including whether dressings are taped to the skin (increases blistering by 15 times) and the mode of application of the dressing. There is much literature out there comparing different post-operative dressings and the risks of complications including blistering and infections. The intra-operative dressings such as Ioban, 3M provide an adhesive antimicrobial drape during the surgery over the overlying knee. The removal of these tightly adherent drapes has been postulated to be a contributory factor in blister development by causing shearing at the dermo-epidermal junction. The aim of these drapes was to reduce the risk of periprosthetic joint infection. The evidence however supporting the use of these drapes is still not available. A recent Cochrane review found no benefit.¹³

Another important factor considered is the use of pneumatic tourniquets. A tourniquet is commonly used in performing arthroplasty surgery of the knee as it improves visualisation, improves operative time, reduces blood loss and provides optimum conditions for cementing.¹⁴ However, it is hypothesised that tourniquet released after dressing application increases shearing forces between the dermis and epidermis due to external fracture while vascular supply to the dermis is compromised by the use of the tourniquet. This led to some authors releasing the tourniquet before applying the dressing. Hozack et al. have shown in their study that releasing the tourniquet prior to dressing application has reduced the incidence of blistering following knee arthroplasty in their cohort of 135 consecutive patients.^{4,14}

The management of blisters remains controversial. Skin blisters provide a sterile biological dressing for the deeper tissues. The fluid within the blister itself is sterile; however, the fluid acts as a perfect culture medium for micro-organisms. There is no clear evidence available to suggest whether de-roofing blisters is the correct thing to do. If the blister is de-roofed, the suggested dressings include topical silver sulfadiazine.⁸

Conclusion

Although there is literature out there on fracture blisters following orthopaedic surgery, we present a rare case of massive haemorrhagic blisters which formed as a result of an active gentleman undergoing an elective total knee replacement for osteoarthritis. Although the appearances can be quite troubling to the patient and the medical team, we have shown from this case that good clinical outcomes are achievable from conservative management of these blisters.

Declarations

Competing Interests: None declared.

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Guarantor: PS

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