



Catastrophic skin necrosis after total knee arthroplasty: a case report and review of the literature

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Introduction and importance: There have been few cases of post total knee arthroplasty (TKA) skin necrosis reported. Here, the authors present our patient with skin necrosis post TKA on account of its extreme rarity, considerable risk factors, and importance of its treatment

Case: This is a cautionary report on the rule of including previous single longitudinal incision in surgical approach. The authors included previous medial incision in ours and performed arthroplasty through medial parapatellar incisions. After noticing skin necrosis in front of patella, reoperation including flap and skin graft was done, leading to complete recovery.

Clinical discussion: While skin necrosis post TKA is not common, it can be present in high-risk patients who should be considered for a decrease in their risk factors. Preoperatively, underlying diseases should be under control. Intraoperation risk factors, in particular incision selection, and considerations about lateral retinacular release are important

Conclusion: A balance must be achieved between the ability to expose the knee through a prior incision and avoiding extensive undermining of the subcutaneous flaps in patients with previous knee surgery. It may be a better approach to ignore medial incisions and use the classic midline incision.

Keywords: arthroplasty, knee, necrosis, skin, wound complication

Introduction

Wound necrosis after total knee arthroplasty (TKA) is uncommon. Some risk factors are considered to be associated with wound complications and necrosis: a. Modifiable patient risk factors including malnutrition, cigarette smoking, alcohol consumption, diabetes mellitus (DM), rheumatoid arthritis (RA), immunosuppressive therapy, and corticosteroid treatments. b. Intraoperative and postoperative risk factors that are inappropriate incision line selection, long high-pressure tourniquet time, tight dressing, deep venous thrombosis, and remaining flexion contracture^[1-4].

Some treatment options for soft tissue defects after knee arthroplasty have been mentioned, such as local wound care,

HIGHLIGHTS

- Regarding skin necrosis post total knee arthroplasty, underlying diseases should be under control.
- Incision selection and considerations about lateral retinacular release are important.
- Consider selecting a considerable interval between the new and previous incisions.
- Postoperative risk factors such as knee flexion in our case should be avoided.
- Aggressive management of wounds and skin problems in these cases can be suggested.

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frequent dressing changes, skin flaps, and skin grafts while the patellar tendon is not exposed; however, there is no universal guideline to approach skin necrosis^[2,5].

To the best of our knowledge, there have been only 12 cases of post-knee-arthroplasty skin necrosis reported as cases in the English literature ever since. Here, we present our patient with skin necrosis post TKA on account of its extreme rarity, considerable risk factors, and importance of its treatment, in addition to a brief literature review of previous reported cases. SCARE 2020 criteria have been followed in reporting this work^[6].

Presentation of case

Ethics statement: Ethical Approval was not necessary as our institution waives ethical approval for retrospective case reports.

A 40-year-old female was referred to our orthopaedic centre (Imam Khomeini Hospital Complex, Tehran University of Medical Sciences) with the chief complaint of both knee pain and deformity, and an inability to walk, dependent on a wheelchair for movement. She was known case of Juvenile Rheumatoid Arthritis (JRA). Five years ago, the patient had gone under both knee arthrotomies with a medial patellar approach and a 5 cm incision length for the management of a septic arthritis. The patient was taking prednisolone 5 mg orally, hydroxychloroquine, methotrexate, and calcium-D supplement. Patients' body mass index was 27.5, with a venous thromboembolic events (VTE) score of B.

On physical examination, the patient had flexion contracture and valgus knee deformity, and both hands and wrists were involved with JRA sequels. The patients' left patella was dislocated and, in the area, scars of previous surgery were visible (Fig. 1). Laboratory investigation showed a normal erythrocyte sedimentation rate of 18 mm/h (normal range: 0–20 mm/h) and a C-reactive protein level of 2 mg/l (normal range: 12 mg/l or less). The bilateral knee X-ray showed a degenerative joint disease (DJD) process (Fig. 2) with the following measured angles: The Genu Valgus angle: right = 20°, left = 22°; the flexion contracture angle: right = 30°, left = 20° (Fig. 3). The neurovascular examination was intact; the other systems' examination was unremarkable.

With a clinical impression of osteoarthritis, the patient underwent left TKA by the senior author (SMJ.M – fellowship trained knee surgeon), receiving a Rotating Hinge Knee (RHK) prosthesis. We made a medial parapatellar incision, including the previous surgery incision in ours. Although a considerable ligament release was performed, eventually a 15–20° flexion contracture remained. Lateral retinaculum tendon release was performed extra-articularly due to patellar maltracking. The wound was approximated with no considerable tension on the edges (Fig. 4). No drain was inserted and immediately after the operation, knee immobilization was done. The patient had postured her knee in flexion due to her desire and, on the sixth postoperative day, presented with a skin necrosis between the operation incisions at the first follow-up visit. Although the administration of antibiotics, the soft tissue necrosis was expanded (Fig. 5), so that the



Figure 1. Preoperation skin and knee deformity condition of the patient.

patient was transferred to the operation room on the 12th postoperative day. Irrigation and debridement were done. A joint fluid aspiration to rule out the joint involvement was performed, which had a negative culture with no leukocytosis. The patient underwent anterolateral perforant flap and autologous skin grafting with an excellent result. Three months later, the wound was healed. Two-year postoperation, the patient had no complications with a good passive and active range of motion from full extension to 135° of flexion (Fig. 6).

Discussion

The burden of knee osteoarthritis is increasing^[7] and the management of TKA complications should be more emphasized. Skin necrosis after knee arthroplasty was observed in 1 out of 210 consecutive TKAs cases by Yashar and colleagues followed by 13 out of 405 primary TKA cases in 1999 by Kim and colleagues.^[8,9] To the best of our knowledge, there are only 12 cases of post-knee-arthroplasty skin necrosis with a complete report as a case in the English literature^[2,3,10,11] which are summarized in Table 1.

The review of literature suggests that necrosis is more prevalent in old age patients with no characteristic sex distribution. Most patients, similar to ours, had been primarily diagnosed with osteoarthritis, while few cases had an infective process post TKA. Previous surgeries and metabolic or degenerative disorders that affect the patients' blood supply or wound healing process are risk factors. As our patient had JRA with immunosuppressive treatment, the scars of previous arthrotomy were making the condition more challenging in this high-risk patient for incision line selection of TKA. Our patient had a valgus deformity. Special attention should be given to valgus deformities when considering the surgical approach. In patients with multiple old scars, it is advisable to utilize the most lateral, vertical incision, even if it requires a lateral arthrotomy. This is particularly important in cases of severe, fixed valgus deformities, as these types of deformities can significantly impact the alignment of the joint and necessitate a cautious surgical strategy to ensure optimal outcomes^[12].

Following primary necrosed skin treatments such as dressing changes, local wound care, and debridement, a specific management strategy such as implant removal, vacuum-assisted closure, skin graft, fascio-cutaneous flap, skin graft, pedicled muscle flap, or muscle transfer is required^[10,11,13]. This protocol should be based on the size, depth, and position of the necrotic wound relative to some landmarks such as the patellar tendon or tibial tubercle^[2]. Topical and hyperbaric oxygen therapy post-operatively is shown to have a considerable effect on wound healing, and prevention of skin necrosis and infection^[14]. Considering all these variables, we applied an anterolateral perforant flap for the patellar skin necrosis of our case that led to an excellent outcome.

Based on our experience with this case, some technical considerations should be noted in order to prevent skin necrosis in high-risk cases:

To select a classic midline incision with a proper distance between previous and new incisions in order to avoid blood supply disturbances

Skin blood supply to the anterior knee comes predominantly from the medial side^[15]. Previous studies have shown that if multiple previous incisions were present, the most lateral usable



Figure 2. Preoperation knee X-ray, anterior and lateral views.



Figure 3. Preoperation knee angles.

incision is our priority to be selected. It is also considered as a rule that preexisting anterior scars on the knee should be incorporated into the skin incision where they are in a usable position^[16]. We believe that our consideration of these rules was one of the etiologies of the skin necrosis.

Avoiding lateral retinacular release

Previous studies have indicated that a lateral retinacular tendon release leads to a decrease in lateral skin oxygenation and subsequently increases the risk of wound complications. If a lateral retinacular release is inevitable, attempts should be made to preserve the lateral superior geniculate artery, such as wound closure without tension, meticulous wound haemostasis to



Figure 4. Postoperation patients' knee and its skin condition.



Figure 5. Postoperative soft tissue necrosis.

prevent haematoma formation, and routine use of suction drainage for reduction in pain and postoperative haematoma formation^[17,18]. So, extra articular reticular release tends to leave arthrotomy open and likely produce subacute haematoma separating the dissected flap leading to tension and likely necrosis. Also, extensive release can lead to damage to blood flow to lateral skin.

To avoid postoperative knee flexion

Reviewing the literature, there are reports which indicate that early knee flexion may also be a cause of skin necrosis or ischaemia after TKA^[19,19]. We recommend that, in such high-risk cases, the surgeon would consider an extended rehabilitation regime postoperation.

To avoid extensive flap

Considering a general caution, it should be noted that extensive flap may lead to skin necrosis as some previous cases of knee surgeries reported in the literature^[20].

Conclusion

To Sum up, it can be said that while skin necrosis post TKA is not common, it can be present in high-risk patients who should be considered for a decrease in their risk factors. Preoperatively, underlying diseases should be under control. Intraoperation risk factors, in particular incision selection, and considerations about lateral retinacular release are important; in patients with previous knee surgery, ignoring medial incisions and selecting a considerable interval between the incisions may be helpful. Postoperative risk factors such as knee flexion in our case should be avoided. Finally, to prevent more complications, aggressive management of wounds and skin problems in these cases can be suggested.

Patient perspective

During the latest follow-up, the patient reported being satisfied with the surgical procedure and treatment. During the examination, the patient declared that he had no discomfort or functional limitations.

Ethical approval

Ethical approval was waived by the authors institution.

Consent

Written informed consent was obtained from the patient for publication of this case report and accompanying images. A copy of the written consent is available for review by the Editor-in-Chief of this journal on request.

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None.



Figure 6. Healed wound and the condition of knee and skin 1-year postoperation.

Table 1
Summary of previous post-knee-arthroplasty skin necrosis in the English literature

No.	Author/ publication date	Patient age/ sex	Pre-arthroplasty diagnosis	Past medical / surgical history	Treatment	Outcome
1	Ries 2002 ^[2]	49 ♂	Post-traumatic arthritis	Multiple scars, prior skin grafting	Removal of TKA, gastrocnemius flap with antibiotic cement spacer. Delayed revision TKA	Revision TKA 6-month posterior to second revision wound was healed with no evidence of infection. ROM 0°–65°
2	Ries 2002 ^[2]	68 ♀	Prior fungal infection of TKA with removal of components	Rheumatoid arthritis Dumping syndrome malnutrition	Removal of TKA, patellectomy, gastrocnemius flap repaired to extensor mechanism with antibiotic cement spacer. Delayed revision TKA	Revision TKA became re-infected 6 months after second revision wound was healed with no evidence of infection. ROM 0°–65°
3	Ries 2002 ^[2]	69 ♂	Prior infection of TKA treated with debridement retaining the components	Skin graft over patellar tendon	Gastrocnemius flap and simultaneous revision TKA	2 years after revision Wound was healed and there was no evidence of infection. 0°–100° ROM
4	Ries 2002 ^[2]	37 ♂	Acute hematogenous infection of TKA	Haemophilia, positive HIV, DM	Removal of patella and TKA components, gastrocnemius muscle flap with antibiotic cement spacer. Delayed revision TKA	Revision TKA became infected. 6 months after second revision wound was healed. 15°–70° ROM
5	Ries 2002 ^[2]	72 ♀	Osteoarthritis with tibial plateau fracture	Skin contusion over proximal part of tibia	Medial gastrocnemius flap, retention of components	2 years after gastrocnemius flap, wound was healed. 0°–90° ROM
6	Ries 2002 ^[2]	79 ♀	Osteoarthritis with severe valgus and flexion contracture	Malnutrition	Removal of tibial tubercle screw	1 year after screw removal, wound was healed. 20°–90° ROM
7	Ries 2002 ^[2]	68 ♂	Osteoarthritis	DM, Prior tibial osteotomy	Removal of components, antibiotic cement spacer insertion, and latissimus free flap	Treated with exchange of antibiotic spacer and medial gastrocnemius flap. 2 years after revision healed wound. 0°–90° ROM
8	Ries 2002 ^[2]	83 ♂	Osteoarthritis	None	Dressing changes	2 years after TKA Wound was healed. 0°–110° ROM
9	Ries 2002 ^[2]	73 ♀	Rheumatoid arthritis	Rheumatoid arthritis	Debridement and skin grafting	2 years after TKA wound was healed. 0°–115° ROM
10	Patella et al. 2008 ^[3]	78 ♂	Osteoarthritis	Allergic diathesis	vacuum-assisted closure therapy and soft tissue coverage using skin grafting	Good passive and active ROM (0°–90°). The pain was absent
11	Sarman et al. 2016 ^[10]	72 ♀	Aseptic loosening post revision TKA	Primary TKA 9 years ago Revision TKA 4 years ago	Serial debridement, convergence sutures and an intermittent vacuum-assisted closure device	No skin complications during routine follow-up was detected, flexion up to 115° in 2 months after closure. was visited 5 years postoperative date when had good condition
12	Alharthi et al. 2019 ^[11]	65 ♀	Osteoarthritis	Hypertension, diabetes mellitus, hypothyroidism	multiple irrigation and debridement and implant removal followed by coverage of the wound with a partial thickness skin graft	No significant complication or infection 3 months after the last procedure was done.

DM, diabetes mellitus; ROM, range of motion; TKA, total knee arthroplasty.

Author contribution

All contributed in study design/ data collection and manuscript drafting/critical revision. All the authors confirmed the final version.

Conflicts of interest disclosure

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