

Combined treatment with vacuum sealing drainage, TopClosure device, and Ilizarov technique for traumatic hemipelvectomy

A rare case report of successful repairing of large-size soft tissue defects

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Abstract

Rationale: Traumatic hemipelvectomy is a rare but lethal catastrophic injury.

Patient concerns: A case of a very young child with open fracture of left sacroiliac joint dislocation and pubic symphysis diastasis, suffered from a severe large-size soft tissue defects.

Diagnosis: Traumatic hemipelvectomy.

Interventions: Complete amputation was performed and three kinds of surgical techniques including regulated negative pressure-assisted wound therapy (RNPT), TopClosure device, and Ilizarov technique were jointly utilized to secure closure in the further revisions of the soft tissue injury and reconstruct reconstructive surgery.

Outcomes: Six months after hospital discharge, the patient was able to ambulate with a single limb and a prosthesis and she is independent in many activities of daily living currently.

Lessons: We report this case to share experience with other clinicians in the management of this deadly extensive defects after traumatic hemipelvectomy in patients.

Abbreviation: RNPT = regulated negative pressure-assisted wound therapy.

Keywords: Ilizarov technique, large-size soft tissue defects, RNPT, TopClosure device, traumatic hemipelvectomy

1. Introduction

Traumatic hemipelvectomy, defined as avulsion through the symphysis pubis and sacroiliac joint with the rupture of ligamentous or neurovascular bundle, is a rare, but lethal

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catastrophic injury with no more than 70 surviving patients reported in the literature.^[1,2] The mechanism of injury is typically a high kinetic energy force and motor vehicle accidents accounting for 80% of them.^[3] Mortality appears to be related to initial severe haemorrhage, multiple organ failure, and septic complications.^[4,5] Here, the authors present a case of a young child with traumatic hemipelvectomy and large soft tissue defects, who was treated with a combination of 3 surgical techniques including regulated negative pressure-assisted wound therapy (RNPT), a TopClosure device, and Ilizarov technique.

2. Case report

A four-year-old girl, presented to our hospital two hours after a motor vehicle accident, where she was hit and run over by a truck. On arrival, she had signs of blood loss externally, was pale, but conscious. Physical examination indicated that pulse rate was 150 beats per minute, blood pressure was 98/64 mm Hg, respiration rate was 26 breaths per minute, and transcutaneous oxygen saturation was 80%. The patient had an extensive degloving injury of skin in the hip and the both legs. Portions of the left femur, tibia, and fibula were exposed, and the lower left extremity was pulseless and lacked motor and sensory function. Meanwhile, anus and the perineum were torn (Fig. 1A). X-ray imaging showed left sacroiliac joint dislocation and pubic symphysis diastasis (Fig. 1B).

The patient's hemodynamic status became stable gradually with immediate administration of crystalloids, packed red blood

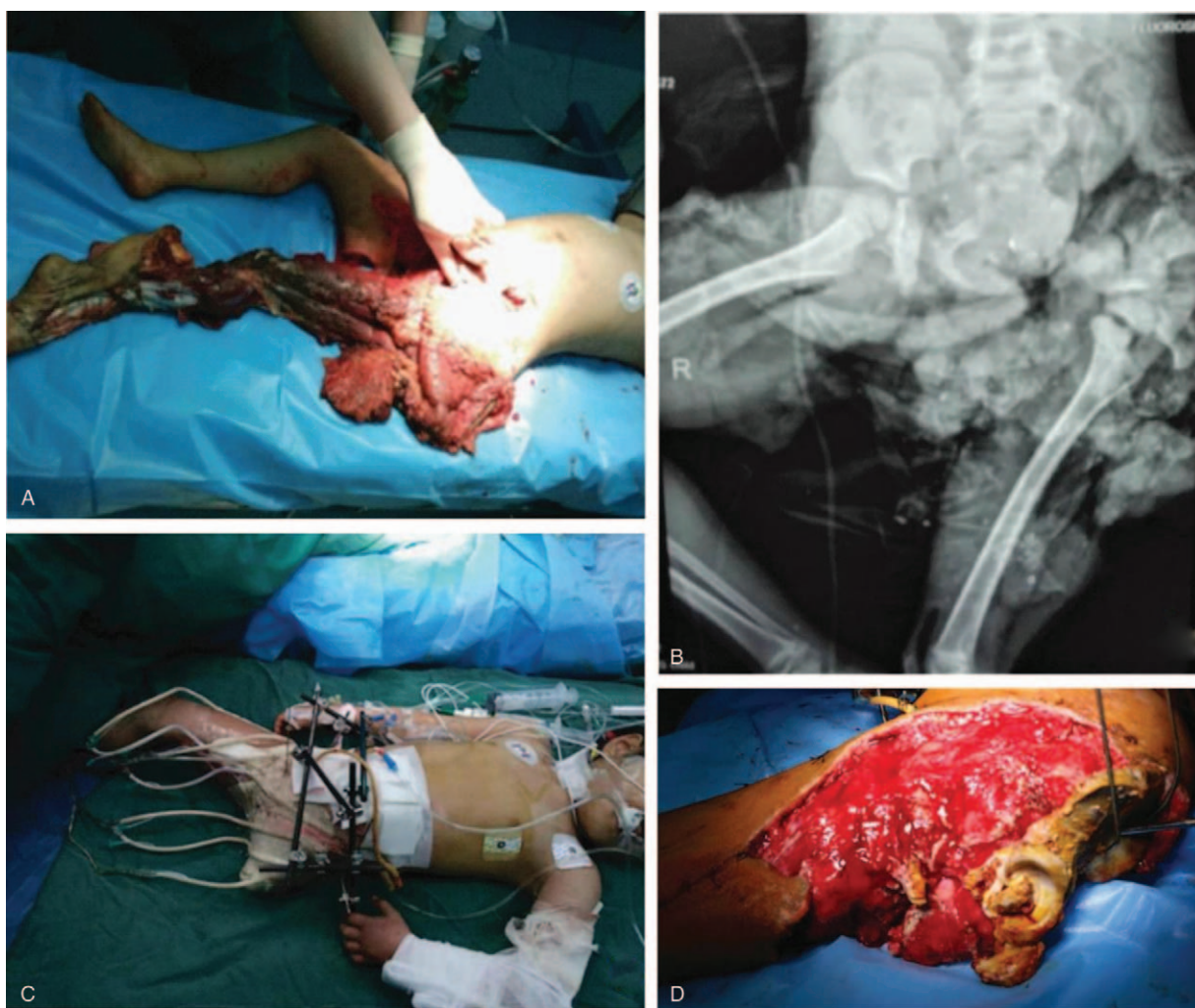


Figure 1. (A) Intraoperative view of the abdominal wall, the gluteal region, and the leg. (B) Admission pelvic anteroposterior X-ray showing the dislocation of the left sacroiliac joint, diastasis of the pubic symphysis. (C) Intraoperative view of a following Ilizarov application and wound management. (D) View of new granulation generated on the surface of the peritoneum in the 3rd debridement.

cells, fresh-frozen plasma, and platelets. Simultaneously, antibiotic treatment added with a combination of second generation cephalosporin and imipenem was applied.

According to the primary assessment consisting of radiographs of chest and pelvis, ultrasound of the abdomen, and catheter drainage of the urinary system, no respiratory and cardiac problems were detected. A complete tear of the urethra and anus was found. Thus, a protective stoma of the transverse colon and insertion of a Foley catheter through the exposed bladder lateral wall were performed to protect the perianal and gluteal wounds from fecal contamination.

The left lower extremity was amputated from hemipelvis, due to the severity of the neurovascular injury. The extension soft tissue wound was lavaged with hydrogen peroxide and saline and debrided thoroughly. This was followed by pulsate lavage and then application of RNPT. Pelvis was stabilized with an external fixator (Fig. 1C).

Serial lavage and debridement was performed once a week following the hemipelvectomy to remove devitalized tissue. By the third debridement, new granulation tissue was generated on the evident on the surface of the peritoneum (Fig. 1D). Thus a TopClosure device, along with a RNPT assisted Ilizarov device

were utilized to aid with wound approximation (Fig. 2). At the base was a polyurethane sponge, cut to fit the wound, and with therapy applied at 125 mm Hg. At the wound edges five TopClosure devices were placed, to gradually stretch and appose the skin edges, while distributing the stress evenly around the wound. The Ilizarov ring at the knee, along with an attached extension pole, was used to aid both attachment of and improving the direction of skin stretch accomplished via the TopClosure device.

At the fourth operation, the skin defect was well-defined, and measured 19×8 cm anteriorly and 29×15 cm posteriorly (Fig. 3A and B). By the 9th debridement, the skin defect had decreased to 14×9 cm, accounting for only 21.5% to original wound area, translating to a skin defect decrease of 7.8 cm^2 per day. Ilizarov device was discontinued as skin coverage had progressed enough to allow direct application of the TopClosure devices (Fig. 3C and D). Eventually 16 serial debridements were needed. At the 17th operation, after the wound had decreased 85% in size, skin grafts were performed (Fig. 3E and F).

The patient's intensive care unit (ICU) course was uneventful. Renal and respiratory functions were normal. On the first postoperative day, the patient was febrile. A combination of

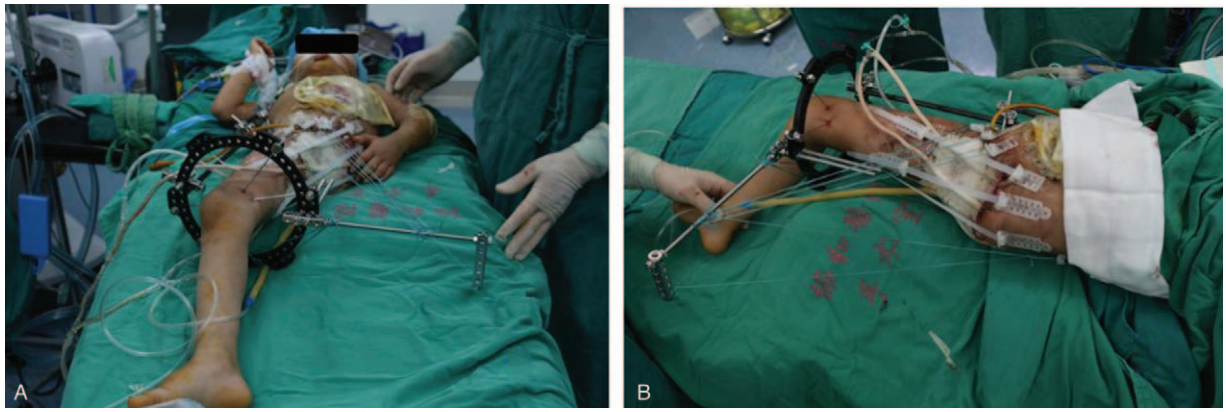


Figure 2. (A and B) View of the combination of devices: the RNPT, Ilizarov, and TopClosure for wound management.



Figure 3. (A and B) Skin defects in the anterior and posterior thigh and perineum before the 4th operation. (C and D) Skin defects decreased to 14 × 9 cm by 9th operation. (E and F) Skin grafted during the 17th operation.

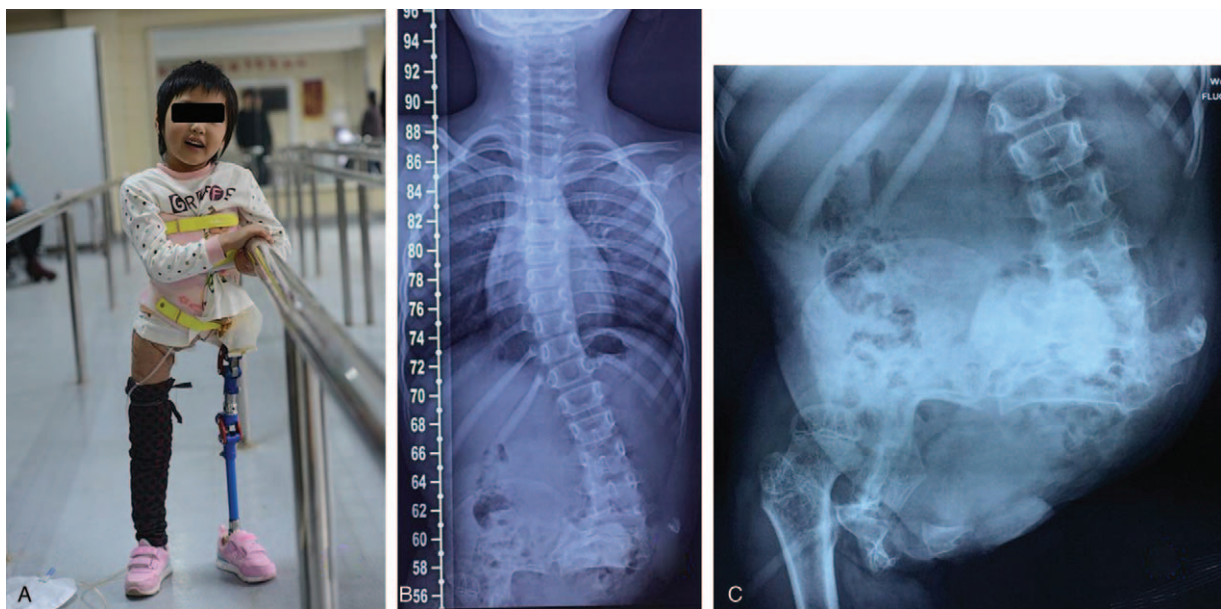


Figure 4. Six months after hospital discharge: (A) patient standing with her prosthesis; (B and C) X-ray films demonstrating scoliosis and subluxation of the right hip.

different antibiotics were used for prophylaxis. After 10 days in the ICU, she was transferred to the general ward.

Six months after hospital discharge, the patient is able to ambulate with a single limb and a prosthesis (Fig. 4A). She is independent in many activities of daily living. She has developed a compensatory scoliosis and subluxation of the right hip, which are being followed clinically (Fig. 4B and C).

3. Discussion

Traumatic hemipelvectomy, with the wide diastasis of the pubic symphysis and sacrum and the possible disruption of the external iliac vessels and femoral and sciatic nerves, is an often lethal type of open pelvic fracture. The principal factors result for the high morbidity and mortality of patients with a traumatic hemipelvectomy are massive blood loss, infection, and multiple organ failure.^[6] Most of the surviving patients reported in the literature are young, likely secondary to the tolerance of massive blood loss and shock.^[4,6]

Complete hemipelvectomy is a reasonable choice for management of traumatic hemipelvectomies.^[3] Attempts at limb salvage are associated with complications and death,^[4,7] and only few successful attempts at reimplantation has been reported.^[8] Walcher et al reported a 30-year-old female involved in a motorcycle accident with an open fracture of the sacroiliac joint, diastasis of the symphysis, and soft tissue trauma around the pelvis. As the femoral nerve and lumbosacral plexus seemed to be intact, reconstruction of the vessels was performed within 2 h of the injury.^[9] In contrast, with our patient, the complete neurovascular injury precluded the consideration of reimplantation, and thus damage control surgery was appropriate.

Infection after traumatic hemipelvectomy is another important clinical consideration. Infection resulting from soft tissue necrosis or contamination from the urinary or intestinal system, is a life-threatening complication after traumatic hemipelvectomy.^[7] Many methods are adopted to prevent the occurrence of infection, including the utilization of antibiotics with perioperative period,

regular debridement and lavage, and RNPT.^[10,11] In this case, a colostomy and cystostomy were utilized early to prevent the fecal contamination from encroaching perianal and gluteal wounds. A second generation cephalosporin, ornidazole, and imipenem were utilized during the entire perioperative period to broadly cover gram-positive bacteria and gram-negative bacteria. Serially lavage and debridement every seven days is supported in the literature.^[12,13] The interval between debridements can be shortened if necessary, depending on the appearance of the wound. Finally, the RNPT system plays a prominent role in the infection management and successful healing of the large wounds. RNPT improves microperfusion, with an increased partial oxygen pressure in the tissue, and thus reduces the bacterial colonization after 4 days.^[14,15] Labler and Trentz cited RNPT use in temporary coverage of large tissue defects in the pelvis region, and for wound conditioning, reduce infectious complications, and facilitate a definitive wound closure.^[10] For our patient, the combination of antibiotics, serial debridement, and RNPT therapy were key in infection prevention.

We utilized three kinds of surgical techniques—RNPT, the TopClosure device, and the Ilizarov technique—to reduce the wound area and promote wound healing. The RNPT system provides vital fluid and perfusion management with negative pressure. The advantages of RNPT as a temporary wound dressing in pelvic trauma was described in the literature.^[16] The RNPT increases both quantitatively and qualitatively the granulation tissue formation on the wound surface.^[17] The TopClosure device, utilized for temporarily skin stretching, comprises two attachment plates that are interconnected by a long, flexible approximation strap. It is able to reduce or totally eliminate tension on the scar to aid the simple closure and fast healing and resulting in an aesthetic, narrower scar.^[18,19] The combination of the two devices, with the RNPT promoting the granulation tissue formation and the TopClosure reducing the wound surface area, is an effective method for wound management. It has been reported that the RNPT and the TopClosure device was effectively used together to close an

abdominal surgical wound.^[18] However, our patient had a much more extensive skin defect, requiring some modification of the TopClosure device plate application. Thus, we utilized an Ilizarov device with an extension pole. This provided an additional attachment point, aiding in attachment of the plates and enable skin stretching in an appropriate direction by tying to the adjustable extension pole. The skin defects rapidly decreased from 587cm² to 87cm² within 59 days, enabling eventual skin grafting, and now a stable soft base for 2 years. The combination of the vacuum sealing drainage, TopClosure device, and Ilizarov technique was successful in managing this complex wound.

The limitation of this case is that traumatic hemipelvectomy with severe large-size soft tissue defects is more rare than traumatic hemipelvectomy. The experience in the management of this case use the combination of RNPT and TopClosure devices, and the Ilizarov technique need more practice to verify its effectiveness.

Author contributions

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