We present a case of left proximal femoral artery transection injury in 1½-year-old male child due to a fall over a bike handle after sustaining a road traffic accident. He was presented to the emergency room with a cut proximal end of the left femoral artery and a fracture upper end of the shaft of the femur seen at the wound site. Following initial resuscitation, the patient was planned for wound exploration, fracture stabilization, and femoral artery repair which were executed, and salvage of the lower limb of 1½-year-old child was achieved. We conclude that teamwork, training, and experience in repairing pediatric vessels and timely pediatric vascular repair play a pivotal role in the salvage of a limb and improvement of the quality of life of a child.

Keywords: Femoral vessel repair, limb salvage, pediatric vascular injury, vascular repair

INTRODUCTION

Pediatric traumatic vascular injuries are rare and are of a great challenge due to low incidence and specific characteristics of pediatric anatomy and physiology. Vascular injuries in children are characterized by a thin wall and small size vessels with poor tissue support and a tendency to undergo vascular spasm. In addition, the small intravascular volume is of great importance in the treatment of pediatric vascular lesions. In general, due to low incidence and specific anatomic and physiological characteristics, vascular injuries in children are a great challenge for the treating surgeon in terms of diagnostics, operative, and postoperative management. The training and experience of a plastic surgeon is indispensable for vessel preparing and anastomosis in pediatric vascular injuries which are characterized by small size thin-walled vessels with poor tissue support and a tendency to undergo vascular spasm. Adult vascular injuries are often managed with success; however, pediatric vascular injury management is a challenge and saves the morbidity of a child which otherwise makes the whole life of the child very difficult. This report is published to spread the message that management is very important not only to save limbs but to improve the quality of life of a child who has to live a long life ahead.

CASE REPORT

A 1½-year-old male child was brought to the emergency room (ER) of our trauma center by his father after sustaining a penetrating injury to his left groin due to a fall over a motorbike handle after sustaining road traffic accident which happened after the wheeler vehicle (motorbike) was hit by a four-wheeler vehicle (car). The patient reached the ER after 4 h of injury and the patient has been managed according
to ATLS protocol in ER by the trauma surgery and critical surgery team the 1st and 4th author. His airway was patent and protected, respiratory rate was 24/min, the bilateral chest was clear on auscultation, and oxygen saturation was 100% on oxygen by mask. His pulse rate was 152/min and her systolic blood pressure was 90 mmHg. His Glasgow coma score was E4 V3 M6. The patient’s hematological and biochemistry investigations including arterial blood gas samples were sent. On local examination, the patient has a lacerated wound of 12 cm × 5 cm over the left anterior aspect of the groin extending from the medial end of the groin to just below of anterior superior iliac spine, clots were present at the wound site with the transected proximal end of the femoral artery seen at wound site with fracture of the femur bone and were exposed [Figure 1a and b]. All distal pulsed in the injured lower limb were not palpable and the left leg was pale and cold to touch. Left lower limb capillary refill was delayed and SpO₂ was not recordable. The other life-threatening injuries such as head, chest, and abdominal injuries were ruled out. After initial resuscitation, one-unit packed blood cell transfusion, and temporarily limb stabilization with slab, the patient was shifted to operation theater (OT) for exploration and repair of the femoral artery. Computerized tomographic angiography was not done as preference was given for the immediate repair of the femoral vessel for limb salvage. Preoperatively, he was administered intravenous antibiotics. The patient was positioned supine, painted, and draping was done. Intraoperatively, wound wash was given with normal saline. The femoral artery, great saphenous vein, and sartorius muscle were transected with an exposed fractured upper end of shaft of left femur bone [Figure 2a and b]. Uniplanar standard mini external fixation of the left femur was applied by the 5th author a pediatric orthopedician. Acceptable anatomical alignment was achieved using C-arm fluoroscopy, following which cut ends of the femoral artery were explored, prepared, and end-end anastomosed with prolene 8-0 suture with micro point round tip needle under ×4 loop magnification [Figure 2c and d] by third author and assisted by second and sixth authors who are from plastic and reconstructive surgeon team with training and experience in microvascular anastomosis. On the operation table, distal saturation and perfusion were checked after vascular anastomosis. Sartorius muscle flap was raised until few centimeters distally to turn over the repaired vessels to provide the first layer of cover followed by closure of wound by approximation of skin and subcutaneous tissues which provide a second layer of cover. In this way, we provided the additional layer of cover with muscle to avoid vessel blowout if the skin and subcutaneous layer dehiscence or necrosis. Postoperatively, distal pulsation and saturation were recordable in OT.

After the operation was completed, the patient was shifted to the intensive care unit where he received initial postoperative care and was administered intravenous

Figure 1: (a) Preoperative photograph of wound at first look in emergency room. (b) Preoperative illustration of wound at first look in emergency room, (a) (preoperative photograph) and Figure (b) (illustration art work) both show a transverse laceration in the left upper thigh with transected femoral artery, great saphenous vein, and sartorius muscle. It also shows exposed femoral vein, femoral nerve, and fractured end of upper end of femur

Figure 2: (a) Intraoperative photograph before vascular repair. (b) Intraoperative illustration of wound before vascular repair, (a) (intraoperative photograph) and (b) (illustration art work) both show a wound exploration in upper thigh with transected femoral artery, great saphenous vein, and sartorius muscle. It also shows exposed femoral vein and femoral nerve after fracture fixation of femur upper end uniplanar external fixator. (c) Intraoperative photograph after vascular repair. (d) Intraoperative illustration of wound after vascular repair. (c) (Intraoperative photograph) and (d) (illustration artwork) both show a repaired femoral artery fracture fixation of femur upper end uniplanar external fixator
antibiotics (cefuroxime, amikacin, and metronidazole) for 5 days, and injection heparin 90 IU/h was administered for 72 h. On postoperative day 1, the patient was conscious and alert and on local examination, left lower limb distal pulses were present, the limb was warm, and the suture line was healthy and saturation was 94%. The patient was advised local hygiene and oral feed was allowed after nutritional assessment. The patient was discharged in stable condition on postoperative day 7th with the advice of regular follow-up in the outpatient department. On follow-up examination, the limb is surviving [Figure 3] evidenced by palpable pulses, 99% of oxygen saturation and healing is also excellent at 3 months. Parents of the child were highly satisfied with the survival of limb of their child. The quality of life is expected to better after the physiotherapy of the limb is over and resumes full function.

**DISCUSSION**

Traumatic pediatric vascular injuries are very rare. In the pediatric age group, most commonly vascular injury occurs because of penetrating injuries and fractures of extremities either as isolated injuries or extremities injury in the polytrauma patient. Timely repair of pediatric vascular injury with expertise improves the outcome and pediatric vascular repair and can save the limb and improve the quality of life of the patient. Surgery is always planned considering the age of the patient, hemodynamic status, imaging findings, and intraoperative findings. Pediatric peripheral vascular injuries are uncommon and account for only 2% of all pediatric injuries.[1] The overall risk of arterial injury with femur fracture or dislocation is very low in cases of blunt trauma.[2] Vascular injuries can have devastating consequences if they go unrecognized, and they should be treated if there are abnormal physical examination findings. In our patient’s case, the traumatic mechanism and the absence of distal pulses were highly suggestive of a vascular (femoral) injury. Pediatric femur fracture and vascular injuries are usually associated with high-energy trauma. Due to low incidence and specific anatomic and physiological characteristics, vascular injuries in children are a great challenge in terms of diagnostics, operative decision and treatment plan, and postoperative management. Vascular injuries in children are characterized by a thin wall and small size vessels with poor tissue support and a tendency to undergo vascular spasm. In addition, the small intravascular volume is of great importance in the treatment of pediatric vascular lesions. Although it is very essential to control bleeding in case of vascular injuries, blind hemostatic clamps should never be applied to the injured vessel.[3] Pressure bandages should always be removed once the patient’s vital signs are stabilized, proper instruments are arranged, proper anesthesia backup, and after shifting the patient to the operating room only.

After obtaining consent from the father, the left femoral arterial injury in our case was explored and repaired with end-to-end primary anastomosis of the femoral artery using prolene 8-0 suture with micro point round tip needle under ×4 loupe magnification. The other options for managing such vessel injury are primary suturing in case of rent, or the use of interposition graft, such as saphenous vein graft, if there is tension or difficulty in primary anastomosis.[4,5]

Limited study and information are known about the outcomes of pediatric vascular reconstructions because a small number of studies have been done on this subject. Of the few reports that have described vascular injuries after femur fractures, none described injuries requiring repair in this age group. In fact, no vascular repair after traumatic femoral vessel injury is reported in literature in any child below 2 years of age.

It was an excellent example of teamwork of trauma and critical surgeons, pediatric orthopedicians, and plastic, reconstructive, and microvascular surgeons in our case with successful repair of femoral artery injury in a child following fall over sharp object after road traffic injury, and we emphasize on teamwork approach and the early and immediate operative decision-making in the case of pediatric patients, thus preventing limb loss with subsequent improvement in quality of life.

**CONCLUSION**

We conclude that teamwork, training, and experience in repairing pediatric vessels and timely pediatric vascular

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**Figure 3:** Postoperative photograph. It shows (a) postoperative photograph of saved viable left lower limb at 3 months of follow-up.
repair play a pivotal role in the salvage of a limb and improvement of the quality of life of a child.

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**Ethical statement**
The patient legal guardian’s consent was obtained, for the procedure and use of patient’s photographs and personal details for academic purposes.

**Declaration of patient consent**
The authors certify that they have obtained all appropriate patient consent forms. In the form, the patient’s guardian has given patient’s consent for patient’s images and other clinical information to be reported in the journal. The patient’s guardian understands that name and initials will not be published and due efforts will be made to conceal identity, but anonymity cannot be guaranteed.

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**Conflicts of interest**
There are no conflicts of interest.

**REFERENCES**

1. Reichard KW, Reyes HM. Vascular trauma and reconstructive approaches. Semin Pediatr Surg 1994;3:124-32.
2. Hoover JD, Almond PS. Isolated pediatric peripheral vascular injury caused by blunt trauma: A new occurrence. J Trauma Acute Care Surg 2004;56:198-200.
3. Soto JA, Minera F, Morales C, Lopera JE, Holguín D, Guarín O, et al. Focal arterial injuries of the proximal extremities: Helical CT arteriography as the initial method of diagnosis. Radiology 2001;218:188-94.
4. Franz RW, Shah KJ, Halaharvi D, Franz ET, Hartman JF, Wright ML. A 5-year review of management of lower extremity arterial injuries at an urban level I trauma center. J Vasc Surg 2011;53:1604-10.
5. Carrillo EH, Spain DA, Miller FB, Richardson JD. Femoral vessel injuries. Surg Clin North Am 2002;82:49-65.