Common femoral artery injury secondary to bicycle handlebar trauma

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Blunt trauma from bicycle handlebars is associated with well-described injuries of the abdominal viscera. These injuries result from the forceful compression of the relatively immobile abdominal organs between the handlebar end and the vertebral bodies. The common femoral artery is also immobile as it passes anterior to the superior pubic ramus, rendering this vessel susceptible to a similar mechanism of injury. We have treated two children who sustained thrombosis of the common femoral artery caused by bicycle handlebar trauma. The lack of familiarity with this uncommon mode of injury may contribute to delayed diagnosis and increased morbidity. We therefore wish to draw attention to this mechanism of injury. (J Vasc Surg 2002;35:589-91.)

Bicycle-related trauma results in more than 500,000 emergency department visits in the United States annually.[1] Between 5% and 10% of serious bicycle injuries are caused by impact with the handlebar.[2,3] One recognized mechanism of injury occurs when the rider falls onto the end of the bicycle handlebar. The abdominal viscera are most commonly injured during handlebar impact. It is hypothesized that these injuries result from the forceful compression of the relatively immobile abdominal organs between the handlebar and the vertebral bodies. The common femoral artery is also immobile as it passes anterior to the superior pubic ramus and femoral head, rendering this vessel susceptible to a similar mechanism of injury. We have treated two children who sustained injury of the common femoral artery caused by bicycle handlebar trauma. The lack of familiarity with this uncommon mode of injury may contribute to delayed diagnosis and increased morbidity. We therefore wish to draw attention to this mechanism of injury.

CASE REPORTS

Case 1. A 13-year-old boy had acute limb ischemia 5 hours after striking his left groin on a bicycle handlebar. The patient complained of leg pain and numbness. On examination, the left lower extremity was cool with absent pulses. A tender, non-pulsatile groin hematoma was present. The ankle-brachial index (ABI) was 0.5 on the left and 1.0 on the right. Occlusion of the common femoral artery at the level of the superior pubic ramus with reconstitution of the distal common femoral via collaterals was demonstrated by means of arteriography (Fig 1). The patient was taken to surgery for revascularization. Because the groin hematoma extended proximal to the inguinal ligament, the external iliac artery was controlled through a retroperitoneal incision. The femoral artery was then exposed through a separate groin incision. A 5-cm segment of the common femoral artery was found to be contused and thrombosed. An intimal disruption and fresh thrombus was shown by means of an examination of the luminal surface. The thrombosed common femoral artery was resected and replaced with an interposition graft of ipsilateral hypogastric artery. Four years after repair, the patient had no claudication, palpable femoral and distal pulses, and symmetric limb length.

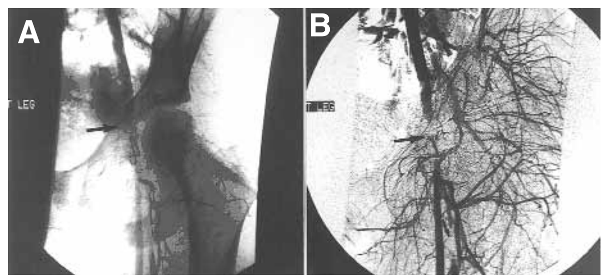

Fig 1. A, Angiogram of patient 1 demonstrating occlusion of common femoral artery at level of superior pubic ramus (*arrow*). **B,** Subtracted view in same patient showing occlusion of common femoral artery (*arrow*) and distal reconstitution through extensive collaterals.

Case 2. A 9-year-old boy was referred to us with disabling thigh and calf claudication 10 weeks after striking his left groin on a bicycle handlebar. A large groin hematoma had been noted at the time of injury, but no vascular evaluation was performed. Claudication had been present since the accident. The left femoral and distal pulses were absent. The ABI was 0.5 on the left and more than 1.0 on the right. Occlusion of the common femoral artery was shown by means of arteriography (Fig 2). The distal common femoral artery reconstituted through extensive hypogastric collaterals. Because of the disabling symptoms and concern for future limb-length discrepancy, revascularization was recommended. The common femoral artery was bypass grafted with a 4-cm length of 6-mm Dacron graft. The proximal and distal anas-

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Competition of interest: nil.

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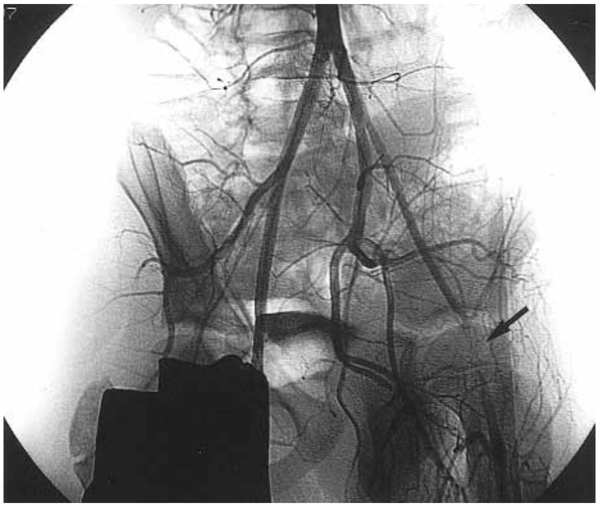

Fig 2. Occlusion of the common femoral artery at the level of the femoral head (*arrow*) in patient 2. Note the extensive hypogastric collaterals.

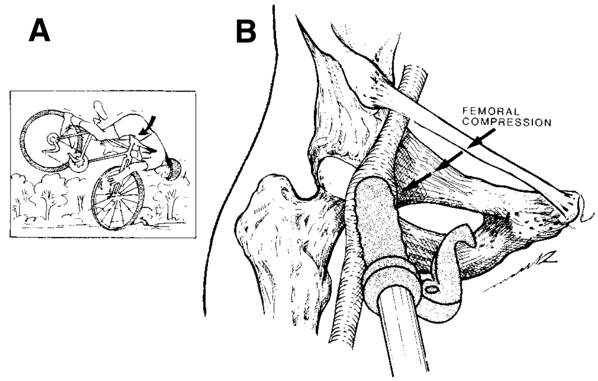

Fig 3. A, Handlebar impact during fall. **B,** Compression of the common femoral artery against the femoral head and pubic ramus.

tomoses were performed end-to-side with interrupted sutures. The ipsilateral hypogastric artery was not used because it had become a significant source of collaterals to the profunda femoris. To avoid the morbidity of an additional incision, the contralateral hypogastric artery was not used. Two years after repair, the patient had no claudication, palpable femoral and distal pulses, and symmetric limb length.

DISCUSSION

Although blunt trauma from bicycle handlebars most commonly causes abdominal injuries, femoral artery injury caused by handlebar trauma has occasionally been reported. Rich should be credited with the first report in the literature.[4] In 1966, he treated a US serviceman who had blunt injury and thrombosis of the common femoral artery after striking his groin on a motor scooter handlebar. Although this injury was caused by a motor scooter and not a bicycle, the mechanism of injury is likely the same. The literature contains three other reports of this injury. In 1986, Stanton et al reported on an 11-year-old boy who had an acutely ischemic lower extremity 48 hours after a handlebar injury.[5] He was found to have arterial occlusion at the level of the inguinal ligament. In 1989, Kioumehr et al reported on a 15-year-old boy who had calf claudication 8 months after a handlebar injury to the groin.[6] A high-grade stenosis of the common femoral artery was revealed by means of angiography. In 1999, Roth and Boyd described the case of a 30-year-old man who had acute limb ischemia after striking his groin on a bicycle handlebar.[7] He was found to have arterial occlusion at the level of the inguinal ligament.

As illustrated by our two patients and the aforementioned reports, the common femoral artery is vulnerable to bicycle handlebar injury. At the inguinal ligament, the femoral artery passes over the superior pubic ramus and femoral head in a superficial position. The femoral artery is relatively immobile because of tethering from arterial branches, periadventitial connective tissue, and the femoral sheath. This lack of mobility renders the common femoral artery vulnerable to compression against the underlying osseous structures (Fig 3*B*). As the rider falls, the bicycle's front wheel and handlebar rotate to a plane perpendicular to the rider so that the point of impact is on the handlebar end (Fig 3*A*).[2] This concentrates the impact over a relatively small area.[8] As a result, a seemingly trivial injury can result in significant force being applied to the artery.[2] It is therefore important to maintain a high degree of suspicion for serious injury when handlebar impact has occurred. Unfamiliarity with this mechanism of injury may explain the significant delay in diagnosis that occurred in four of the six reported cases.

As with most bicycle-related trauma, handlebar injury of the femoral artery is more common in children. Four of the six reported cases occurred in patients younger than 15 years. Although standard surgical principles apply to the management of pediatric extremity arterial injuries, there are additional considerations. Chronic ischemia and claudication that is well-tolerated in an elderly patient may have serious consequences in a child. Disabling claudication may have significant social and developmental implications in a child. Furthermore, chronic ischemia can impair growth-plate function, resulting in limb-length discrepancy and permanent gait abnormalities. Revascularization has been shown to reduce the occurrence of limb-length discrepancy.[9]

Repair of arterial injuries in children can be accomplished by using standard vascular surgical techniques with certain modifications.[10] We advocate the primary repair of arterial injuries when possible. In blunt trauma, the extent of arterial damage may preclude primary repair. The long-term durability of prosthetic grafts in pediatric extremity injuries is unknown; therefore, when grafting is required, we generally favor autogenous conduits. The greater saphenous vein may be used; however, in certain situations, its diameter may be inadequate. Larger grafts can be prepared with the hypogastric artery, internal jugular vein, basilic vein, or saphenous vein panel or spiral grafts. When performing an arterial reconstruction in children, we use interrupted sutures and generous spatulation of the anastomosis. The bypass graft is configured to preserve important collateral pathways.

The possibility of femoral artery injury should be considered in patients who have sustained bicycle handlebar trauma. We advocate revascularization in children, even in the absence of limb-threatening ischemia, because of the theoretical risk of developing limb-length discrepancy in the injured limb.

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