A non-contact complete knee dislocation with popliteal artery disruption, a rare martial arts injury

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Summary

Complete knee dislocation is a rare injury and an associated incidence of popliteal artery damage ranges from 16–60% of cases. It occurs commonly in road traffic accidents and in high velocity trauma where significant contact remains as the usual mode of injury. We describe a rare case of non-contact knee dislocation with popliteal artery injury sustained while practising Aikido, a type of martial art. This patient successfully underwent closed reduction of the knee with an emergency vein bypass graft. Similar injury in association with Aikido has not been described in the English literature previously. Various martial art injuries are briefly discussed and safety recommendations made.

Keywords: Aikido; knee dislocation; popliteal artery disruption; sports injury

'Martial arts' is a generic term encompassing a group of various fighting techniques that primarily use different body parts with or without weapons.¹ The main projected benefits of martial arts are self-defence, and increase of fitness, flexibility and self-esteem. A few of these special techniques include karate, kendo, Tae Kwon Do, kungfu and Aikido.¹ The term Aikido means the way (*do*) for the co-ordination or harmony (*ai*) of mental energy or spirit (*ki*). Morehei Uyeshiba, a Japanese master, founded Aikido nearly 50 years ago.² Martial arts in general are considered as a safe sport. However, there are reports of serious injuries including several deaths in the last few years.^{3,4} In this article we report a case of disabling knee injury associated with vascular compromise needing emergency limb revascularisation surgery.

Case report

A 20-year-old man was brought to the emergency room with alleged history of sustaining an accidental injury to his left knee while practising Aikido. He explained that he had lost his footing while carrying someone piggyback, and fell forward with his leg bent behind the body axis. On examination he had a complete left knee dislocation with anterior displacement of tibia and fibula. His left foot was cold and cyanosed without palpable pedal pulses. Closed reduction of the dislocated knee

Figure 1 Operative arteriogram showing total blockage of popliteal artery (arrow)

under general anaesthesia was carried out successfully. Detailed examination of the left knee revealed complete disruption of posterior capsule, anterior cruciate ligament, and posterior cruciate ligament and varus valgus instability. An intra-operative arteriogram revealed complete blockage of the popliteal artery (figure 1) with no filling of distal vessels. He underwent end-to-side anastomosis using a reversed saphenous vein bypass graft to join the distal superficial femoral artery and tibioperoneal trunk successfully. The limb was immobilised in flexion using a cast.

Postoperatively, the limb survived and he gradually recovered. A repeat arteriogram done 4 months later confirmed a well functioning graft with a good runoff (figure 2). He received rigorous physiotherapy and rehabilitation over a period of 10 months. His proprioception improved gradually to 100%, as did his motor function. Interestingly, he never experienced a feeling of instability throughout this period. He was doing well at follow-up after 16 months.

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Figure 2 Follow-up arteriogram showing a well functioning graft with non-filling of proximal popliteal artery

Learning points

- initial vascular assessment is mandatory in all cases of acute limb trauma, including those caused by martial arts
- the attending surgeon must aim at limb salvage by correcting vascular injury first
- soft tissue repair is not always necessary in an anterior knee dislocation, especially when collateral ligaments are preserved

groin protection and proper boxing gloves. They also reiterated the need for further research to study injury pathogenesis, promote better training techniques, and to design better safety equipment and rules for this sport.⁴

Dislocation of the knee is an uncommon injury from any trauma and the reported incidence varies from 14 in 2 million total admissions to the Mayo Clinic between 1911 and 1960 to two cases out of 140 231 in a series in Philadelphia.^{5 6} The knee dislocation can be associated with popliteal artery injury in 16–60% of cases^{5 6} and nerve injury in 16–43% of cases⁵. An inadequate initial assessment and delay of vascular repair could lead to an amputation rate of 87%.^{5 6} Hence, revascularisation takes precedence over the repair of injured ligaments. The management of ligamentous injury following complete knee dislocation is unclear and controversial.⁵ Cumulative data suggest that primary surgical repair in general will yield better functional results than conservative treatment.⁵ However, of all types of knee dislocation, the anterior type is more suitable for non-operative management as it seems to spare collateral ligaments.⁵

Non-contact complete knee dislocation is exceedingly rare and has not been described previously in association with Aikido.⁴ The presented case was a complete anterior knee dislocation disrupting the popliteal artery and damaging all the ligamentous structures except both collateral ligaments. The patient was successfully revascularised and managed conservatively. This case highlights the importance of early limb revascularisation and postoperative rehabilitation in achieving a successful outcome in this disabling injury.

Proper medical supervision, supervised training by certified instructors, and adequate use of safety equipment while practising martial arts may prevent these serious injuries.

Discussion

About 95% of the martial art injuries are minor, involving the extremities in 70% of cases.¹ Birrer and Birrer, in their 1981 analysis of over 24 000 martial arts injuries (quoted in ¹), estimated that 1 in 500 could be serious. In 1997, Wilkerson reported three deaths in association with martial art injuries, all due to anterior chest trauma.³ A few of the reported serious martial art injuries include skull fractures with or without cerebral contusion, subdural haematoma, rib fractures with haemothorax, traumatic retinopathy, hepatosplenic lacerations, and fractures involving the spine, face and hip.^{1 3 4} Oler *et al*⁴ discussed various factors predisposing to serious injuries involving martial arts and made some important safety recommendations: the establishment of minimum standards and certification for instructors and medical practitioners who supervise these events, and the mandatory use of head gear, mouth wear, torso protection,

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Digoxin, hypercalcaemia, and cardiac conduction

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Summary

The cardiac effects of hypercalcaemia are usually manifest as a shortening of the QT-interval. Hypercalcaemia is infrequently associated with a clinically manifest arrhythmia. However, concomitant therapy with digoxin or underlying cardiac disease can potentiate the arrhythmogenic effects of hypercalcaemia, leading to a symptomatic rhythm disorder. We describe a symptomatic arrhythmia, which developed in a patient with hypercalcaemia secondary to squamous cell carcinoma of the bronchus. The patient was on digoxin therapy at the time. The arrhythmia did not recur after discontinuation of digoxin therapy and correction of the hypercalcaemia. Because of its effect on cardiac conduction, hypercalcaemia should be considered in the evaluation of any patient with an unexplained bradyarrhythmia. Conversely, patients with hypercalcaemia should discontinue digoxin therapy and be evaluated for the presence of rhythm disorders while receiving appropriate treatment for hypercalcaemia.

Keywords: hypercalcaemia; bradycardia; cardiac conduction; arrhythmia

Clinical observations of conduction disturbances caused by hypercalcaemia are rare. A few case reports exist describing patients with bradyarrhythmias such as atrioventricular (AV) nodal conduction defects, sinus node dysfunction and atrial fibrillation in the setting of hypercalcaemia. Underlying disease of the conduction system or cardiomyopathy may play a role in the pathogenesis of the observed arrhythmias.^{1,2} We describe a patient with hypercalcaemia due to malignancy who developed a symptomatic bradyarrhythmia while on digoxin therapy and review the literature.

Case report

An 81-year-old woman had a sudden syncopal episode without premonitory symptoms while having a meal. She regained consciousness within one minute. Bystanders noted a slow radial pulse and a flushed complexion. She was admitted to a local hospital for evaluation and continuous cardiac monitoring.

Over the year preceding admission, she had been evaluated repeatedly by her local physician for weakness, dyspnoea and malaise associated with an unexplained 4.5 kg weight loss.

A presumptive diagnosis of congestive heart failure was made and since that time, the patient had been treated with digoxin and loop diuretics. Over the 8 weeks prior to admission, she developed a cough productive of green sputum.

During the 12 hours following admission, the patient had several sinus pauses of 2.0 to 5.1 seconds. Laboratory evaluation on admission was remarkable for a total calcium of 3.0 mmol/l (normal 2.2–2.5). The serum digoxin level was 1.5 ng/ml (0.5–2.0). The chest X-ray showed a left upper lobe infiltrate of indeterminate nature but was otherwise unremarkable with no signs of congestive heart failure or pulmonary venous hypertension. The patient was transferred to our facility for further evaluation and treatment.

Physical examination revealed an elderly woman in no apparent distress. There was no palpable lymphadenopathy. Her pulse was regular in rate and rhythm at 74 beats/minute. There were no added heart sounds and examination of her chest and abdomen was unremarkable. She was oriented to time, place and person and there were no focal neurological deficits.

A 12-lead electrocardiogram (ECG) obtained on admission was notable for the presence of first-degree AV block. Temporary transvenous pacing was established. The hypercalcaemia resolved after intravenous hydration and diuretic therapy. Subsequently, no further sinus pauses were observed. A computed tomography scan of the thorax revealed an ill-defined, peripheral, bronchocentric lesion in the left upper lobe. Mediastinal and hilar adenopathy was also present. Trans-thoracic echocardiography showed a normal ejection fraction of 55%. There were no regional wall motion abnormalities. The serum parathyroid hormone was appropriately suppressed at 0.8 pmol/l (1.0–5.2). Bronchoscopy revealed an endobronchial lesion in the right main bronchus that was biopsied. The histology showed Grade 3 squamous cell carcinoma. An oncology consultation was obtained and after explanation of the therapeutic options, the patient elected not to pursue chemotherapy or radiotherapy.

Since the patient declined therapy for her malignancy, she was felt to be at risk for recurrent bradyarrhythmias and a permanent pacemaker was placed to prevent further symptoms. Digoxin was discontinued and she was discharged home after uneventful pacemaker placement. First degree AV block was still present on the ECG obtained on dismissal. Serum calcium levels were normal at that time.

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