Review Article

Indian Journal of Neurotrauma (IJNT)
2004, Vol. 1, No. 2, pp. 21-23

Injection Injuries of Peripheral Nerves

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Abstract: Inadvertant injection into or in the vicinity is a common cause, but least discussed aspect of peripheral nerve trauma. The recommended treatment has ranged from a conservative approach to immediate operative exposure and irrigation. Treatment options include early neurolysis, delayed exploration with neurolysis, or resection and anastomosis. Prevention is the most important aspect and due care should be exercised while administering intramuscular injection.

Keywords: intramuscular injection nerve injury, neurolysis, neuroma

Introduction

Injury to peripheral nerves due to injections of therapeutic and other agents is common. In a study of 226 patients with iatrogenic peripheral nerve injuries, the injuries were incurred through injection of therapeutic agents in 84 patients, inadvertent division by the surgeon in 44, traction during orthopedic operation in 27, and undue compression from an ill fitting splint or plaster cast in 26[1]. Thus injection palsy is a leading cause of iatrogenic nerve injuries. The postulated mechanisms of injection injury include direct needle trauma, secondary constriction by scar, and direct nerve fiber damage by neurotoxic chemicals in the injected agent. Neurological sequelae can range from minor transient sensory disturbance to severe sensory loss and paralysis with poor recovery. The recommended treatment has ranged from a conservative approach to immediate operative exposure and irrigation. Treatment options include early neurolysis, delayed exploration with neurolysis, or resection and anastomosis[2].

Site of injury

The sciatic and radial nerves are, by far, the most commonly affected[3]. In a study of 380 cases of sciatic nerve injuries, injection injury comprised of 50% of total injuries and is the commonest cause of sciatic nerve injury at buttock[4]. Within the sciatic nerve the common peroneal division is more susceptible to trauma because of its more superficial and lateral location[5].

Unusually, patients with predominant or sole damage to the posterior tibial nerve trunk are also reported[6]. The other nerves involved by intramuscular injection injuries are median nerve[7], peroneal nerve[8] , posterior femoral cutaneous nerve[9] and even more than one nerve in case of infrapyriformis syndrome[10]

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Mechanism of Injury

Direct needle trauma

The site of injection is the most crucial factor in determining the degree of nerve fiber injury. Following intrafascicular injection, the degree of injury varies significantly. Most moderate or severe injection injuries are the result of direct intrafascicular injection into the nerve trunk[3]. In an experimental study, intrafascicular injection was invariably associated with severe nerve injury, and, with few exceptions, extrafascicular injection resulted in minimal damage[11]. The injury occurs early following intrafascicular injection than extrafascicular injection and may proceed quickly to a certain degree of severity[12].

Constriction by scar

Extensive scar formation in the perineural tissue results in secondary constriction of the nerve[3]. Even internal fibrosis of the nerve is of importance as a pathogenetic mechanism in injection injuries[6].

Nerve damage by neurotoxic chemical in the agent injected

The nature of the injected drug is also important, as certain drugs are much more damaging than others when injected into a peripheral nerve. The most toxic agents are penicillin, diazepam, chlorpromazine, meperidine, dimenhydrinate, tetanus toxoid, procaine and hydrocortisone[3]. In an experimental study minimal damage resulted from the injection of iron dextran, meperidine, and cephalothin, and maximal nerve injury followed the injection of penicillin, diazepam, and chlorpromazine[11]. In a study of 27 children with injection injury, drugs administered were chloroquine, novalgin, paraldehyde, procaine penicillin, and sulfadoxine

pyrimethamine[13]. Among anti-emetics, prochlorperazine appears to be least neurotoxic when injected intraneurally. Extensive scar formation in the perineural tissue results in secondary constriction of the nerve[3]. Even internal fibrosis of the nerve is of importance as a pathogenetic mechanism in injection injuries[6]. Among steroids dexamethasone appears to be the safest and hydrocortisone being most toxic to nerves[14]

Pathological alterations in the nerve are evident as early as 30 minutes after injection. The mechanism of injury appears to be a direct neurotoxic effect on the nerve fibre both axon and Schwann cell, with a breakdown in the blood nerve barrier[11]. Intraneural degenerative changes and epineural cellular proliferation occurs following injection in nerves. Intrafascicular injection causes diffuse or focal axonal injury depending upon the chemical injected. The quantity of drug injected is also important in determining the degree of injury. Large, heavily myelinated fibers are more susceptible to injection injury than smaller, thinly myelinated nerve fibers. The effect of the injected drug seems to be related to injury of the nerve fiber unit, both the axon and the Schwann cell, with its myelin sheath. Regeneration in damaged nerves is a constant finding; even the most severely injured nerves, with total axonal degeneration, undergo subsequent regeneration[11].

Clinical features

Injection palsy more often occurs in infants and younger children[15]. The clinical features can range from minor, transient, sensory disturbances to severe sensory loss and motor paralysis with poor recovery. The clinical picture is characterized by the predominance of motor over sensory disturbances[16].

Sciatic nerve damage by intragluteal injections tends to injure the peroneal nerve trunk more severely than the other components of the sciatic nerve but rarely predominant or sole damage to the posterior tibial nerve trunk occurs[6]-.

Treatment

Initially, the patient should be managed conservatively along the well-established lines for patients suffering from lesions in continuity. Patients with partial deficits uncomplicated by severe pain or with significant spontaneous recovery or late referral can be managed medically. Surgical exploration is not indicated in as many as 50% of injuries[4]. Most of these patients achieve partial but good spontaneous recovery. It is essential, however, that these lesions be followed closely and that conservative -management not be prolonged in those patients who do not exhibit recovery at the expected time following injury. Some authors have advocated that neurolysis as early as possible in cases of injection injury[17]. Surgical intervention is required for more complete and persistent deficits[3].

The prognosis for recovery will, as with other injuries, depend to some extent on the specific nerve involved and the level of injection. As compared to sciatic nerve, radial nerve injection palsy has much poorer prognosis and most of the cases require tendon transfers[18].

At operation, careful inspection of the nerve is important, since external appearance may be misleading in view of intraneural location of the pathology. Intraoperative electrophysiological studies are helpful in assessing the presence and extent of regeneration, and in deciding whether resection and anastomosis is indicated. Care must be taken to appreciate the whole extent of the lesion, which often affects a much longer segment of nerve than might be expected. Rarely, causalgia like pain will persist in the distribution of the injected nerve despite adequate motor recovery and require sympathetic block, sympathectomy, or surgical neurolysis[3].

Prevention

As with other iatrogenic nerve injuries, prevention must play a major role in the overall management of injection injuries. The need to discourage indiscriminate use of intramuscular injections and choice of a proper site of injection should be stressed. It is suggested that the intramuscular route for injection be strongly discouraged when a drug can be given by other routes. Only trained staff should be allowed to administer intramuscular injections and there is a need for proper training of paramedical workers. The superolateral gluteal area between the crest of the ilium and the greater trochanter must be properly defined as the preferred site for intramuscular injection in buttocks. Though giving intramuscular injections at sites other than the buttock is clearly advantageous in children aged five years and below, buttocks should preferably be avoided as an intramuscular injection site in all children whatever their age[15].

With determination and public education, the risk of this iatrogenic tragedy could be minimized.

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