72

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REGENERATION OF HYPOGASTRIC NERVE USING A POLYGLYCOLIC ACID(PGA)-COLLAGEN NERVE CONDUIT FILLED WITH COLLAGEN SPONGE PROVED ELECTROPHYSIOLOGICALLY IN A CANINE MODEL

Hypothesis / aims of study

A new type of a biodegradable artificial nerve conduit, polyglycolic acid (PGA)-collagen nerve conduit filled with collagen sponge, has been developed and evaluated for peripheral nerve regeneration (1,2). The hypogastric nerve (HGN) is a sympathetic nerve and controls urinary and seminal functions. Bilateral HGN are often excised in the operations of malignant tumors, such as prostate cancer, bladder cancer, and rectal cancer, because of the local extension of the tumor or lymph node dissection. Although autonomic nerve preserving procedures have been attempted to avoid functional disturbance during such operations, the efficacy and indication are still limited. Autonomic nerve regeneration using an artificial nerve conduit has not yet been reported. The aim of this study is to determine whether the gap of HGN was interposed with the aid of this new artificial nerve conduit, PGA-collagen nerve conduit filled with collagen sponge in a canine model, and the period of functional recovery was determined electrophisiologically 4-8 months intervals after the operation.

Study design, materials and methods

Twelve adult male beagle dogs were divided into 2 groups, the control group (n=2) and the implanted group (n=10). The right HGN was cut with surgical scissors and a 10 mm long segment of HGN was removed. A PGA-collagen nerve conduit (tube with 2mm in diameter) with a length of 20 mm was interposed in the 10 mm gap. Each end of the tube was cut longitudinally 5 mm along the length of the conduit, and the proximal and distal nerve stumps end of the HGN were inserted into the opened part of the nerve conduit to a depth of 5mm (gap=10mm). The end of the stumps of the HGN was fixed to the conduit at the edge of the cut and the longitudinal cut lines were closed without suturing the nerve. The regeneration of the HGN was evaluated electrophysiologically 4 months (n=2), 5 months (n=2), 6 months (n=2), 7 months (n=2) and 8 months (n=2) after the operation, by stimulating the lumbar splanchnic nerves (LSNs) from L2 to L4 and measuring the response of the spermatic duct, bladder neck, and prostate. Before the nerve stimulation in all of the dogs, the left HGN was transected to eliminate the substitutive pathways.

Results

In the control, electrostimulation of the left LSNs induced elevation of intraluminal pressure of the spermatic duct (80 mmHg amplitude, and 10 seconds duration), elevation of bladder neck pressure (20mmHg amplitude), and prostate contraction (25 seconds duration). When the right HGN was transected after the measurement, no response was observed by the stimulation of the left LSNs (contro). In the dogs with 7 months as well as 8 months follow-up, electrostimulation of left LSNs elicited elevation of intraluminal pressure of the spermatic duct (about 80mmHg, and 10 seconds), elevation of bladder neck pressure (about 25 mmHg, and 20 seconds), and prostate contraction (20 seconds). After the excision of the area of the interposed right HGN, no response was observed. In the dogs with 4, 5, or 6 months follow-up, no response was observed by stimulation of the left LSNs.

Interpretation of results

These results proved that the regeneration of HGN using new PGA-collagen nerve conduit could be achieved within 8 months.

Concluding message

The HGN could be regenerated across a 10mm gap with 7 or 8 months follow-up with the aid of a PGA-collagen nerve conduit filled with collagen sponge. The regeneration of HGN using this nerve conduit will be great help for patients who suffer from urinary and seminal disturbance.